

Artisanal and Informal Mining in Peru

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*The author wishes to thank Mrs. Zoila Martinez Castilla,
Executive Director of Ekamolle, for her valuable
commentaries and cooperation.*

*This report was commissioned by the MMSD project of IIED. It remains the sole
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Mining, Minerals and
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The project was made
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I Introduction

Artisanal mining is an important phenomenon in many parts of the world. From the small production of coal in China to gold washing in different parts of South America, it is estimated that this activity employs more than 13 million persons (International Labour Organization, 1999). At the same time, it is also known that these artisanal operations are characterized by their low productivity, scarce safety conditions and negative impact on the environment.

The origin of artisanal mining differs from one country to another, and even from one zone to another. In the first place, there are cultural reasons for mining in an artisanal manner in certain zones. Generation after generation have been dedicated to this activity and, although options may exist for technology transfer and channelling of financial resources, miners prefer to continue producing in the same manner as their forefathers. This is the case of the “pirquineros” in Chile. In the second place, the discovery of a mineralised vein, especially those with high precious metal content, attracts people who see an opportunity for increasing their incomes rapidly. The gold fever in many parts of the world, clearly illustrates this phenomenon. Finally, artisanal mining is one of the few subsistence alternatives in depressed areas, where other labour intensive activities, such as agriculture do not exist or have disappeared.

In Peru, artisanal mining has proliferated due to a combination of survival and opportunity. It is a type of mining that produces gold exclusively. In an area such as Madre de Dios, one of the least populated departments of the country, the discovery of gold in placers and riverbeds, caused a massive immigration from the poorer regions. On the other hand, in the mid south, the exit of inhabitants from zones stricken by terrorist violence and there being gold deposits not attractive to mining companies, this activity has developed to a point that it is now the main economic activity of the area.

Artisanal operations are to be found in mineralised areas that have always been worked by traditional methods, such as some areas in Puno, where the exploitation of these deposits dates back to Colonial times and where large scale mine investment has not been promoted. Artisanal mining is also carried out in mines that have been abandoned by mining companies. This is the case of the mines of La Libertad and others in the mid south zone, where, due to profitability problems, have had to close down and large investment would be required to reopen them. Finally, artisanal operations are abundant in high-grade deposits without sufficient reserves to justify the high investment required for their preparation and development. These deposits of which there are many in the mid south, can only be exploited by selective mining methods such as those used by artisanal mining.

In Peru, a country where the economic rate of growth has been decreasing since the decade of the ‘70s, artisanal mining has become an important work generator for people unable to find employment in the ever weaker labour markets. The income of artisanal miners is estimated at us\$200 per month, almost double the minimum vital wage paid in the city of Lima (us\$117 per month), but is only slightly higher than the roof of the poverty level estimated at us\$170 for a home of 5 persons (Piazza, 2000). Due to measurement problems and the lack of sufficient coverage by the different census taken, it is only estimated that this

type of mining employs between 20,000 and 30,000 families. This is almost a half of the jobs generated by formal mining. Also, it is known that large mining requires 5.5 men days to produce a kilogram of gold, medium and small mining requires between 60 and 180 man days and artisanal mining, 575.

These different labour requirements are due to the fact that artisanal mining depends on the physical effort of the miner. In the manner that the level of technology advances, the labour requirements decrease. But the level of technology in a mining operation, is subject to the geologic and mineralization characteristics of a deposit. For this reason, artisanal mining subsists despite the efforts of the authorities or institutions to mechanize it with the hope of increasing productivity, and in this manner improve the income of the persons involved.

However, this does not mean that there is no room for intervention destined to improve the efficiency of this activity. Environmental management and occupational safety, are two important areas where there can and must be intervention. The inappropriate use of consumables such as mercury, not only damage the environment where artisanal mining is practised, but it also endangers the life of the miners and their families. In the same manner, the low security levels in this type of mining, contribute to accidents that are frequently fatal.

Another area of intervention is the legal situation of the artisanal miners. Due to the disorderly development of artisanal operations, where the miners invade an area to work it, and the lack of knowledge of existing legislation, the majority of these operations are informal or illegal. This situation, from every point of view is inconvenient. On the one hand, it produces disorderly production, and the miners who do not plan their work, end up working the deposit inefficiently and abandon the works to invade richer deposits. Frequently, unplanned work does not allow for the deposits to be worked again, as the supporting structures are too weak. Unplanned work also results in bad environmental management, which, for example, can increase the grade of erosion and deteriorate the standard of living of the mining communities.

This informal manner of operating, ends up converting itself into a disadvantage for the artisanal miners themselves who, when they discover, frequently by force, that the deposits they are working have owners, they must come to an agreement with the titleholders of the concession or with the ore processors. In the majority of cases, the agreements turn out to be very disadvantageous for the miners and obtain nothing more than to perpetuate their precarious economic situation. This last, generates a series of problems that end up affecting those less protected sectors of the population such as women and children. Both groups end up working in the mines or the artisanal concentration installations to enable them to contribute to the family income, risking their health, and in the case of children, the possibility of adequate physical and mental development.

On the other hand, these invasions of ore deposits with titleholders cause them difficulties, particularly when they have a going operation. The security measures that they must take to guard their rights, increase their operating costs. Many times, arbitrary agreements are reached that sometimes place limits for the artisanal miners, but keeping those agreements is done in a permanent atmosphere of conflict.

Finally, the State is also harmed as it is deprived of the taxes for the mining rights to be paid by the miners. An important case that must be emphasized, is the abundance of informal operations in Madre de Dios, that have quite high levels of mechanization and that have an annual production of over 11 tons of gold. Another consequence of the informal situation, is the difficulty for the State to fiscalize these operations and to care that this mining activity develops in a sustainable manner.

The problem of artisanal mining informality, requires amongst other things, an adequate legal framework. The present mining legislation is focused on providing incentives for investment and the development of large deposits. There is no differential treatment for the various mining categories, except for small mining in specific points such as the tariffs for the maintenance of concessions. This brings difficulties to the artisanal miners that wish to formalize their situation, because the present legal requirements are beyond their technical and economic possibilities.

As in other parts of the world, the subject of artisanal mining in Peru has caught the attention of the authorities, national and international institutions and organisms. In the last ten years, a series of measures have been taken attacking the different problems of this activity. A first step has been to prepare a data survey in order to estimate the size of artisanal mining in each of the mining areas identified and to try to remediate and prevent further environmental damage. However, the authorities understand that any support program for this sector should have a global focus towards increasing the capacity of the artisanal miners and their families; providing an adequate legal framework that takes into account the limited size of the artisanal operations and differentiate the informal miners who wish to be considered as artisanal, in order to benefit from a special treatment; and transfer adequate technology to increase the efficiency of artisanal operations.

The present report, will describe the main characteristics of artisanal mining in Peru. In the following section, the four zones that concentrate the greater part of artisanal mining activity are described, emphasizing the mineralogical characteristics and the methods of exploration, production and beneficiation used. Section three details the principle environmental impacts generated by this activity. Section four analyses the health and occupational safety situation of the artisanal miners. Section five shows the administrative problems of the artisanal miners. Section six analyses the legality problem of the artisanal miner operations and the impact that public politics have had on this activity. Section seven indicates the main support proposals and initiatives that have been tried over the last years. Finally, the last section offers some conclusions and recommendations.

2 The principle areas of artisanal mining

Artisanal gold mining is carried out in different geographic areas of the country, but four areas have been studied that have the major concentration of artisanal miners. As can be seen in **Table 1**, the estimates made by the Ministry of Energy and Mines¹, show that a

¹ Many people who study the theme, state that the estimates of the Ministry of Energy and Mines are extremely conservative. There is consensus that the number of miners is over 30,000,

little more than 70% of the gold produced in the country by artisanal or informal means, comes from Madre de Dios, and that almost a half of the artisanal miners work in this department. Madre de Dios has the greatest productivity of all the regions (1.2 kgs. Per man per year) due to, as can be seen further on, to the mechanization of a large part of the operations. The second mining area in importance is Puno, with around 17% of the gold production, 33% of the number of miners and an average production of 0.34.

The Mid South² is in third place in production and the number of miners working in the area. However, their average production is slightly higher than Puno (0.36 kgs per man year). Finally, in La Libertad, artisanal mining employs about 700 persons and produces 191 kgs per year, with a lower productivity (0.27) than the other areas.

It can be seen in the same table, that artisanal gold production is equivalent to 17% of the total gold production. Before the large gold mine producers started to function such as, Yanacocha and Pierina in the mid 90's, artisanal mining represented about 50% of the gold produced (12,000 of the 20,000 kgs of fine gold in 1990 and 24,500 of the 48,000 kgs in 1994). At the same time, artisanal mining adds 22 thousand workers to the 60,000 employed by formal mining, equivalent to a third of the mineworkers.

Table I Estimated fine gold production (Kg)

Minino area	No. Of Miners	Annual production	Average productivity
Madre de Dios	9,480	11,419	1.20
Sur Medio	4,690	1,665	0.36
Puno	7,562	2,536	0.34
La Libertad	700	191	0.27
Total artisanal	22,432	15,811	0.70
□Minino total	60,465*	93,982	

* Does not include employees in artisanal mining.

Source: Ministry of Energy and Mines (1998)

2.1 Madre de Dios³

there are also references that the figure may reach 50,000 persons if the seasonal workers are considered, but there are no clear estimates on their number. Therefore, the difference in figures includes a counting problem, as well as the consideration of permanent and seasonal workers. There are investigators, such as those of the OIT, that prefer to talk of mining families as in this manner they can easily include the work of women and children.

² This is one of the mining areas, where the number of miners is underestimated. Some studies indicate that this area has more than 10,000 miners (Zevallos, 1994)

³ The information used for the preparation of this section, comes principally from (Pasco-Font, Trillo, Llosa and Naranjo; Piazza, 2000)

The department of Madre de Dios is located in the southern Forests of Peru and borders with Brazil and Bolivia. Madre de Dios is composed mainly of zones with abundant vegetation, within which are the National Reserves of Manu and Tambopata, refuges rich in flora and fauna. A series of indigenous ethnic groups inhabit the area, that conserves their ancestral habits.

The gold placers of Madre de Dios have been worked since colonial times. However, it is since 1977 that the old river channels – also known as forest terraces – have been worked. The alluvials are located in the courses of the rivers Huaypetuhe, Madre de Dios and Malinowski.

The river Huaypetuhe basin is worked the most by artisanal and informal miners. This is the foothills zone where alluvial placers are abundant. It is in this zone, that 80% of the population and gold production of the department is concentrated and is reached via Puerto Maldonado or via Cuzco. The villages in this basin are precarious, as the miners do not normally live with their families in the zone where they work. A survey carried out by GRADE, reports that 51.2% of the families of those interviewed, stay in their places of origin, Cuzco, Puno or Apurimac (Pasco-Font, et al.,1994)

In the river Madre de Dios basin, there are smaller villages than those encountered when entering by river from Laberinto (1 hour from Puerto Maldonado). The stretch between the mouth of the river Colorado and the city of Puerto Maldonado, is more attractive to the artisanal miners. It has several important populated centres, where the majority of the inhabitants are dedicated to gold mining. Amongst them are: Tres Islas, La Pastora, Laberinto and Colorado. There are also 43 native communities in the Madre de Dios basin, with whom there are conflicts.

According to Piazza (2000), there are 15,000 families living in this zone, of which, 9,500 are mining families. Alluvial mining is carried out principally during the rainy months, so an important part of the mining activities is seasonal, especially as children may be incorporated in the work during their school holidays.

The dwellings are made of wood with a corrugated iron roof and mounted on wooden pillars. They have electrical energy 4 hours per day from 6pm to 10pm. There is a restricted telephone service and parabolic antennas. In the ravines, the dwellings are of palm branches covered with plastic. There is no water or drainage. Electrical energy is obtained from generators. These are temporary camps.

There is only one initial educational centre composed two schools and a secondary college. Around 40% of the students work in mining during the weekends. There is a high rate of student desertion. In the secondary school, only 30% of the students are miners children and the rest are the children of the traders. This poor educational coverage is due to the temporary nature of the mining settlements.

There are two health posts, one in Huaypetuhe and the other in Caychive (New) with limited equipment, which does not permit any intervention when there are occupational accidents.

Huaypetuhe has a very dynamic commercial activity. There is a series of commercial establishments such as restaurants, bars, clothing stores, machinery and equipment. The bars and canteens have expanded in the township, generating adolescent prostitution. To this it should be added high indices of delinquency and street violence (raping of women and minors), family violence, stealing and robbery. There are not sufficient police and the few that exist do not enter the camps.

In the river Madre de Dios basin, dwellings are made of wood and other rustic materials. In Laberinto and San Juan, the shacks have corrugated iron roofing whilst in Tres Islas and other localities they are of scrap metal sheets. There is no public water system or drainage and electricity exists only in Laberinto and San Juan. In other camps, they obtain electricity from generators.

Laberinto has a secondary school, but the levels of desertion are high, as the adolescents usually work in mining. The rest of the localities only have primary schools.

Laberinto has a health centre and there are others in Tres Islas, Boca Inabari, Boca Union, Lagarto, Tumi and San Juan. In the same manner as Huaypetuhe, the proliferation of canteens and the lack of police protection, have made Laberinto a very violent place, where assaults and homicides are frequent.

2.2 Mid South⁴

The Mid South is the mining area that covers the southern part of the Department of Ica, the western part of the Department of Ayacucho and the northern part of the department of Arequipa. In the Mid South, there are more than 60 mining camps located in the provinces of Nazca and Palpa (Ica); Lucanas and Sancos (Ayacucho) and Caraveli, Condesuyos and La Joya (Arequipa) (See Table 2.) This mining area is accessible by land over the Pan-American Highway and tracks leading to the mining settlements.

The most important concentrations of artisanal miners are: Saramarca and Tulin in Ica; Huanca and Jaqui in Ayacucho and, Huanu Huanu in Arequipa. Amongst these, are mines where a good part of the miners are concentrated such as, Saramarca (500) and Uchiza (500) in Saramarca; Lajas (300) and Otoa (300) in Tulin; Huanca (1000) in Huanca; Santa Filomena (600) and San Luis (659) in Jaqui; Tocota (2000), Mollehuaca (1000) in Huanu Huanu. (Zevallos, 1994). However, it is important to mention that these numbers may have changed depending on the discovery of new veins. Many of the miners could have migrated to new mines. Such is the case with Lomo de Camello, located in Tulin, where recently there was a “burst”, that is, a new vein was discovered that has attracted a large number of miners.

⁴ The information used for this section is taken principally from (Aquino, Cajachagua and Bouchard, 2001; Lazar, Trillo, and Sanchez, 1995a; Piazza, 2000)

In the Mid-South, the mines are located in the upper parts of the basins, many of them are arid areas and the miners have to obtain their water and food from other places. The concentration installations, the quimbaletes⁵ and plant installations are located in the lower parts where water is found, either from the rivers or from shallow subterranean deposits.

Table 2 Principle Artisanal Mining Areas in the Mid-South (2000)

Department	Province	Mining Settlements
Ica	Nazca	El Ingenio-Tulin Sol De Oro Vista Alegre
	Palpa	Saramarca Pampa Blanca Rio Grande
Arequipa	Caraveli	Huanu Huanu Mollehuaca Chaparra Quicacha
	Condesuyos-Acarí	Acari Eugenia Cerro Rico
	La Joya	La Joya Los Incas
Ayacucho	Sancos	Pullo Relave Santa Filomena San Luis Santa Ana Santa Rosa Millonaria Santa Rita Convento Jaquí Filomena
	Lucanas	Minino Otocha, Chavincha

The Mid-South is an area where an important number of people from the poorer departments of Peru have settled.. These are, Ayacucho, Huancavelica and Apurimac.

⁵ As is explained further on, the quimbalete is an artisanal tool used in the initial part of the beneficiation of gold ores.

(Zevallos,1994), has identified several migratory movements. During the period 1900 – 1969, the cotton boom in the department of Ica, produced a seasonal migratory movement taking advantage of employment opportunities generated by export agriculture, but the migrants later returned to their original communities. Later, between 1960 and 1969, the incipient process of industrialization, especially in the coastal departments, attracted the mountain populations. During 1970 – 1979, the crisis in the countryside became accentuated, the previous temporary migrants, settled permanently in the coastal farms and with the advent of the Agrarian Reform, became members of the new cooperatives, motivating the arrival of the rest of the family. Finally, during 1980 – 1994, the migration was no longer the search for new opportunities, but rather an exodus due to terrorist violence in the mountainous departments and in particular, Ayacucho. The migration became disorderly and was for survival. Many families had to abandon all their activities and start from zero in the areas where they arrived.

Table 3 Activity engaged upon their arrival to the mining areas

Preference	Frequency	Percent (%)
Activities related to gold	588	93.48
Transport	1	0.16
Commerce	5	0.79
Agriculture	18	2.86
Fishing	0	0.00
Building	3	0.48
Catering services	1	0.16
Non gold worker	4	0.64
Minino company worker	3	0.48
Formal	0	0.00
Others	6	0.95
Total	629	100.00

Source: Villachica, Carlos, Alberto Pascó-Font, Jaime Llamosas and Gonzalo Llosa 1994). “Study on informal mining and environment in the departments of Ica and Arequipa” Project for the Analysis, Planning and Execution of Policies (PAPI) – Agreement Peruvian Government – USAID Lima.

In this circumstance, artisanal mining became an activity for refuge for these families that had lost everything. **Table 3** shows that mining became the principle activity for more than 90% of the migrants that arrived to the Mid South. Additionally, the economic crisis of the decade of the 1980s that produced the sustained deterioration of coastal agriculture and industries, converted artisanal mining into an alternative to the lack of employment in the economy. With this background, it is not surprising to find mining settlements with a migrant population of over 80% and, on the other hand, settlements that were originally agricultural, turned into totally mining communities.

Due to the availability of information, this section will describe the principle indicators of the mining communities of Tulin and Saramarca in Ica; Huanca, Santa Filomena and Relave in Ayacucho; and Mollehuaca in Arequipa.

Tulin and Sarmamarca

Tulin is originally an agricultural area. It has a population of approximately 1,860 that are dedicated mainly to mining and about 15% to agriculture. The majority of the population is from the zone or comes from neighbouring zones.

Tulin has a paved highway over which any vehicle up to 10 tons can circulate. There is a transport service of minibuses that communicate with the city of Nazca. The township has an initial educational centre and a primary school attended by 52 and 178 children respectively. It also has a health post managed by a Doctor and a Nurse. With respect to basic infrastructure, this mining settlement has electricity and potable water but no drainage facilities. There is a television retransmitting station that allows the people to view some open signal channels.

With regards to social services, Tulin has two dining halls for mothers and one for children. There is a chapel and a volleyball sports club.

Tulin is a community that has grown considerably in recent years, without major planning. The quimabeletes are located in the township itself and the inhabitants are requesting their relocation to the outskirts in order to preserve the health of the population. At this time, there is a high level of unemployment of the young men, which has increased the problem of alcoholism and family violence. The inhabitants denounce some police abuse who confiscate their mineral and the collection of quotas. This occurs because the miners are informal and work the concessions of others.

Sarmamarca is a community of 500 inhabitants that come mainly from the neighbouring areas (Ica, Ocaña, Ayacucho) and other more distant areas such as Puno, Cuzco and Huancavelica. Mining was initiated more than 30 years ago by organized miners. The artisanal miners commenced their workings in 1988 and were 900 in number, but the low gold contents were responsible for the exit of most of them in search of new deposits. A small part of the population is dedicated to agriculture.

Access to Sarmamarca is by two vehicle accessible roads: Laramata-Ocaña-Sarmamarca and Palpa-Sarmamarca. This community has a basic educational centre and a primary school attended by 14 and 75 children respectively. There are no potable water installations or electricity. It has a medical centre attended by a Doctor and a Nurse.

Sarmamarca does not have popular or children's dining halls, but does have the Glass of Milk program. It has a Catholic chapel and the presence of an Israeli sect. This community has football and volleyball clubs.

As in Tulin, Sarmamarca is trying to get the quimabeletes relocated outside the township. They also have an alcohol problem with the young men who are unemployed. Due to the reduction in metallic content, the population wishes that support programs for agriculture and other productive activities be introduced.

Huanca and Jaqui

Huanca has approximately 600 inhabitants that come mainly from the Mid South and is located on land belonging to a farming community. From 1985, artisanal mining was commenced when an important vein was found in the surrounding hills. This caused some conflicts as the community does not accept the miners.

Access to Huanca is by a very broken up track. The dwellings of the inhabitants (farmers) are made from adobe, thatch and eternit. A channel provides water to the homes. Another more modest type of home is used by the miners. These are of more unstable material of reed and cane. This is because the majority of the miners do not live permanently in Huanca. A third type of dwelling used by the commercial inhabitants (mainly from Puno) , is faced with cement and has eternit roofs. The village has electrical energy installed in 80% of the dwellings and 30% are connected to the water system.

There is a PRONOEI (15 children) , a CEI (20 children) and a primary school (108 children), 95% of the children belong to the miners. It is estimated that 80% of the students work in mining, services, agriculture and livestock. There is a health post with limited medication and no equipment to attend emergencies. It is attended by two nursing technicians.

Huanca has two mother's clubs that administer the two popular dining halls. A bakery is being formed and will be administered by the mothers. With regards to the miners, a project for the installation of a communal retort⁶ is under way and with the help of the ecclesiastic organizations, a chapel is being built. There are no religious sects in the village. Several non-government organizations (NGO) have been working in Huanca.

Ninety per cent (90%) of the heads of family are dedicated to mining, but in Huanca agricultural and small scale livestock activities are developed. There are possibilities for developing aquiculture (trout and shrimp breeding) in the river Acari.

On the other hand, Santa Filomena which is the principle mine in Jaqui, congregates around it approximately 1,700 inhabitants that come from the Mid South. Mine workings commenced around 1925 by a foreign company that abandoned its operations. Artisanal mining becomes a permanent activity towards the end of the 80's.

Access to Santa Filomena is via Yauca, a community at Km. 574 on the Pan-American Highway South. The homes in this community are of rush matting and poles which are located around the mine entrance are in danger of caving. Water is provided by the industrial processing plants through mill and quimbaleta operators. A section of the population, purchases electricity from a generator.

⁶ The retort is an artefact used for the burning of the gold amalgam. It is a closed recipient that permits the recovery of the mercury and impedes the liberation of it's gasses. The communal retort is a project that will permit those that burn the gold, work jointly ,making the burning process more efficient and reduce the environmental contamination.

Santa Filomena has an initial educational centre, a primary school and as from the year 2000, will be providing secondary education through a development project of a non-government organization. This community has a health post with basic equipment that is attended by two nurses and two assistants.

Santa Filomena has a mother's club and a sewing and knitting workshop that was created with the support of an NGO and financing from the OIT. There is also a popular dining hall. There is no chapel and consequently no religious services. However, the Israeli sect is present.

Commercial activity is increasing in the zone, thanks to NGO projects. Due to the arid nature of the zone, the land has no agricultural value.

Mollehuaca and Relave

According to the census carried out in 1997, Mollehuaca has a population of 1,154 which are mainly migrant, originating from 62 provinces from the coastal and mountainous zones of Peru. More than 70% of the occupied population (451 persons) were involved in activities related to artisanal mining (marinez,1999).

Almost half of the dwellings in Mollehuaca are of adobe and the other half of reed matting and wood with plastic roofing. A water network has been installed that benefits 70% of the families, with financing from IPEC and OIT. There is electricity from 5 pm to 10 pm from a generator, allowing families to have two bulbs per house and a television or radio. There is also a parabolic antenna.

A primary and an initial education centre were built in 1990. Primary education covers only 30% of the families (considering one child per family). This year, a secondary school has been opened, so that children that wish to continue with their education, will no longer have to travel on foot to the secondary school in Relave (6 kms).

A health centre was built by the initiative of the community, with the help of the Program for Primary health of the Prelature of Caraceli and has been equipped by a non-government organization and financing from the IPEC program of the OIT.

There is commercial activity such as stores, bazaars and small restaurants. A non-government organization has created workshops for sewing, knitting and gold jewellery. There is also an effort to try to recover some land for small-scale agriculture.

Relave has a population of about 2000, of which the majority (80%) come from the same zone and therefore there is a strong social cohesion. The development and joint action are carried out under the system of communal work.

In Relave, the homes were initially of matting and plastic and they have now passed to adobe covered with cement and corrugated iron roofing. Five percent (5%) have their own silo. The equipment for water and electricity were purchased with contributions from the inhabitants and maintenance is a community activity. There is electricity from 5 pm to 11

pm and the water distribution system is through public faucets. Due to the deficiency in water distribution, there is the intention to install a complete system for potable water.

There is an initial educational centre, with primary and secondary schools. The educational buildings have been built with communal work and at first, the teachers were contracted by the township itself. The majority of the adolescents do not study because they are obliged to work in the mine.

They have a place for a medical post built by the community. The inhabitants contracted paramedical personnel to attend the post, but the precarious equipment and the lack of capacity of the people contracted, were the causes for its closure. The committee Pro-Post has chosen an area for the construction of an adequate post and have initiated procedures with the Health authorities in Ayacucho.

Artisanal mining is the only activity in this community. All supplies, both for daily life and for mining activities, are brought in from other communities. There is a circuit of stores and a fair is held on Sundays. There is a daily transport service between Chala and Relave.

2.3 Puno⁷

The department of Puno is in the southern mountain range and is the highest department of Peru. It has a long mining tradition dating back to the Colony. The mining potential of the department, includes resources such as gold, and more recently the base metals.

The provinces where artisanal mining activities are concentrated are, San Antonio de Putina where the mining areas of Ananea, La Rinconada, Cerro Lunar and Ancoccala are located. On the other side, in the province of Sandia are the mines San Antonio del Oro, Yanahuaya and Masiapo amongst others. There are other provinces such as Carabaya and Lampa, where artisanal mining is also carried out, but in a more scattered form.

Many of these mining areas are at altitudes of above 4000 meters above sea level and artisanal mining becomes a very hard activity.

Ananea

The Ananea mining district is in the province of San Antonio de Putina. About 800 families live there distributed in several communities. According to a census carried out by IDESI, 53% of the mining contractors interviewed are dedicated exclusively to mining (Lazaro, et al, 1995a).

The township of Ananea is 7 hours away from Juliaca. To access this district, there is public transport that circulates on dirt roads once a day. The dwellings in this district are made of adobe and stone and corrugated iron roofs. There is potable water but no drainage and from the year 2000, they have electricity.

⁷ The information used for this section, comes principally from (Lazaro, et al., 1995 a).

There is an initial educational centre, a primary school for 290 and a secondary college for 170, both are State institutions and their coverage is only 57.5%. Due to the high incidence of child labour, the schools function until 1 pm, after which the children work in mining (50% primary and 90% secondary). (Piazza,2000)

There is a health centre in Ananea that is attended by a doctor an obstetric and a nursing technician. This centre also administers a complementary nutrition program for children with high risk of malnutrition. As with the other mining areas, there is no occupational health program in the area.

In the higher regions of Ananea, the communities are dedicated to breeding Alpacas. Commercial activity in the township is very limited.

La Rinconada and Cerro Lunar

La Rinconada and Cerro Lunar are two adjacent settlements that were built around the mining activity. Their joint population is of 8,000 families: 5,000 La Rinconada and 3,000 in Cerro Lunar, most of which are in the artisanal mining activity. There is information that least 800 women have mining activities as they belong to an association of “pallaqueras”, however, this number is underestimated and is below the true feminine participation in mine work.

The dwellings in these settlements, are even more precarious than those in Ananea and have walls and roofs of corrugate iron. There is no potable water: the population buy chlorinated water or use water from melting ice. Electrical energy has been installed recently as well as some public telephones, radio transmitters and antennas for TV reception.

Despite the fact that the educational demand is for at least 10,000 children, there is only one primary school for 500 children in two shifts, a secondary school for 170, an initial educational centre for 60 and two PRONOEIs attended by 140 children and three private colleges for 252. This means that only 6.7% of the children of school age can be attended.

There is a health centre with personnel but without equipment for specialized analysis. This centre administers programs for child growth control and nutritional complementation. This last program is managed jointly with the mother’s clubs that exist in the township.

These two settlements are very dynamic commercially and in services. There are several general stores, pharmacies, tailors, hairdressers, restaurants etc.

These settlements have problems with street violence, alcoholism, delinquency and prostitution.

2.4 La Libertad

The department of La Libertad is located on the northern coast of the country, although a part of it extends into the mountainous region where the mining activity is located. Mining

in La Libertad is concentrated in the province of Pataz, to the extreme east of the department. Due to the Western mountain range, the province of Pataz has mountainous terrain and there are areas where the altitude is above 3,000 m.a.s.l.

Mining in this area, dates back to the beginning of the century. Companies such as, Northern Mining Co., Compañía Minera Parcoy and Compañía Minera Buldibuyo S.A., had their operations in the Pataz district and to the south to the district of Tayabamba. These companies abandoned their mines and the ex-workers are dedicated to working them. However, there are new companies established in the zone of Retamas-Parcoy and Llacuabamba such as, Consorcio Minero Horizonte and Minera Aurífera Retamas.

At this time, artisanal mining activities are concentrated in the townships of Pataz, Retamas, Parcoy and Buldibuyo.

The township of Pataz is in the department of the same name. It has a population of about 1,350 families that are distributed between the principle population centre and 13 annexes. There are approximately 830 families in mining activities in three annexes: Campamento, Pueblo Nuevo and Zarumilla. Although the population of Pataz is not strictly from the township, it does come from neighbouring areas.

Access to Pataz is via Trujillo over 370 kms of compacted road to Chagual then to Pataz also over a compacted road. Alternatively, it is possible to fly from Trujillo by small planes to Chagual.

The dwellings in Pataz are of adobe with earth floors and tiled roofs. Others have corrugated iron, eternit or other light material roofs. The township has a non-potable water distribution system and little drainage facilities. An electricity service is being installed, but to the moment, the mining company La Poderosa services 30% of the homes with electricity four hours per day. A public telephone service was installed recently.

Pataz has a State CEI and school, a private secondary college and a Superior Technical Mining Institute.

There is a health centre that provides general medical services, obstetrics, nursing pharmacy and laboratory.

Although artisanal mining is the main activity, commerce and agriculture are also important. There are general stores and electrical appliances and also, agricultural fairs over the weekends.

3 The deposits and production methods⁸

3.1 Madre de Dios

Description of the deposits

The economically workable deposits occur in alluvials or placers. There are two main forms of these deposits. The placers in the foothills areas that are from 20 to 70 mts thick. Mineralization occurs vertically and horizontally. The contents are from 200 to 250 mg. Au/m³. These placers are found on the beaches of the rivers Caychive, Huaypethue and tributaries.

The placers in the alluvial plains correspond to deposits from the rivers Madre de Dios, Malinowski and the lower part of Tambopata . The deposits are approximately 300 mts long by 100 mts wide and contain from 1 to 2gms Au/m³. Because of their high grades, these are the most worked (Pasco-Font, et al.,1994)

Exploration, exploitation and beneficiation⁹

Exploration is carried out by very rudimentary methods, depending on the zone where the deposit is located. The geological parameters that permit an economic evaluation of a deposit are unknown, as also the principle tools of modern exploration such as aerial photographs.

In the forest areas, the miners drive a steel bar into the earth to detect where the gold bearing gravel lies. After this procedure, samples of gravel are dug out with shovels to verify the existence of gold. This done by visual inspection and where more colours are found, obviously this has a higher gold content. In the foothills areas, the steel rod is not required as the gravels are on the surface and only a shovel is used to take samples and inspect them for colours.

Finally, exploration of the river beaches is effected when the river water level decreases and the beaches are exposed. Again, samples are obtained with shovels and inspected for the presence of colours. Exploration of the riverbeds is effected by suction dredges that suck the gravels from the bottom of the river and then proceed with visual inspection.

⁸ The information used for this section, comes principally from: Lazaro, et al., 1995a; Lazaro,Trillo,Sanchez, Susano, Pinilla, Sanchez and Jaramillo, 1995b, Pasco-Font, et al.,1994, Villachica, Pasco-Font, Llamosas and Llosa, 1994)

⁹ For the effects of this report, the mining process has been divided into these three basic steps. Exploration refers to activities to identify new deposits. As artisanal mining operations are rudimentary, exploitation or production refers mainly to the mining and movement of the ore. Beneficiation includes crushing, grinding and amalgamation or cyanidation. In the case of alluvial deposits, beneficiation is by gravity methods, that is, using the different densities and weights of the material extracted and in some cases, subsequent amalgamation.

In the ore extraction, there is quite a diversity of technology. From mechanized operations that utilize front loaders and dump trucks, to operations that have the most rudimentary technology. For this reason, it is not possible to talk generically of artisanal mining in Madre de Dios. The mechanized operations are informal, not because of a lack of resources or knowledge, but with the express intention of staying on the margin of legality and thus avoid the costs and controls imposed by the State.¹⁰

Table 4 shows the different production systems and the hectares worked, the material extracted and the personnel used in each method. It can be seen that artisanal operations are the majority and generate the major part of the employment in the zone, especially those using sluice boxes, channelling and dragging. However, it is not surprising that the semi mechanized operations, concentrate the major part of the gold bearing material extracted (84%).

Manual work is prevalent in the artisanal methods. Artisanal production are classified into, channelling, sluice box, “caranchera”, suction and balsas (6” suction) operations. The channelling operations are common in the foothill areas, especially in Cayviche and Huaypetuhe. With this method, the gold bearing material is shovelled into a channel where water is circulated and drags the material to a sluice box for recovery.

Table 4 Principle indicators by type of mining operation in Madre de Dios (1995)

Type	Has. Worked		Extraction (m3/día)		Workers	
		%		%		%
Artisanal methods						
Channelling	288	20.1	1,598	1.0	647	8.6
Dragging	150	10.5	2,093	1.4	615	8.2
Sluicing	635	44.4	8,344	5.4	3,500	46.6
“Caranchera”	67	4.7	4,475	2.9	368	4.9
Suction	40	2.8	6,320	4.1	340	4.5
6” Dredge	30	2.1	1,845	1.2	147	2.0
Mini-dredge	4	0.3	112	0.1	14	0.02
Semi-mechanized methods						
Chute Loader	215	15.0	129,666	83.8	1,879	25.0
8” Dredge	2	0.1	240	0.2	7	0.1

Source: Ministry of Energy and Mines.

The sluice box method is used principally on river beaches. It consists of feeding the sluice by wheelbarrows and shovels where the gravels are washed with abundant water provided

¹⁰ (Chaparro, 2000) qualifies these miners as “uncontrolled”. They “consciously resist State actions. With some reserve they fraternize with the community, generally generating conflicts with it, the authorities and the workers.... The almost always call themselves ‘small miners’ and continuously claim assistance from the State, even though they resist complying with State regulations (Chaparro, 2000), p.44-45.

by motor pumps or with buckets. This method has several limitations, in the first place it is limited by the underground water level of the terrain and, the lack of knowledge of pump maintenance, which increases their costs. Finally, it is a method which does not permit an increase in production volumes and consequently can only be used in high-grade locations (Pasco-Font et al, 1994).

The drag method is common in the foothill areas. This consists of exploiting the outcropping gravels on the slopes, using the inclination to eliminate sterile material by gravity with the help of streams of water under pressure to loosen the gravels (monitoring) which fall, or are pushed by workers, into a trench dug into the ground and the workers shovel this material into a sluice box for final recovery. This method requires 16 HP pumps with 3" outlets.

The "caranchera" method, is used mainly on the river beaches. A Diver with a suction hose connected to a pump, sucks up the gold bearing material that lies below the subterranean water level into a bin to store the sands. The suction method is similar except that the material is first loosened by monitoring and the loosened material accumulates below the subterranean water level with a higher percentage of solids than the previous method.

Finally, the method using rafts is used for the riverbeds. The gravels on the riverbed are sucked up through 6" hoses - manipulated under water by a diver - by 35 HP pumps. The pumps and sluice boxes are installed on a floating platform.

With the semi-mechanized methods, extraction is performed by mechanized methods but final recovery is performed manually. **Table 5** shows the evolution of the use of heavy equipment in mining operations. It shows how front-end loaders and dump trucks have a marked increase in their use, which indicates an increase in semi-mechanized operations. From 1998, the table shows the units in operation and not the total existing, as one of the main operating problems is poor equipment maintenance.

Table 5 Heavy equipment used in gold mining at Madre de Dios

Years	Front end loaders	Dump trucks	Excavators	Dozers
1995	245	---	---	---
1996	351	81	1	7
1997	468	136	4	7
1998	563	178	6	7
1998*	297	122	3	0
1999	243	121	3	0
2000	232	124	5	0

* Units in operation

Source: Ministry of Energy and Mines

A first method, is the use of suction dredges which are similar to the raft method but differ in the diameters of the suction ducts which are 8", 10" and up to 12". The suction ducts are of iron and their movements are directed by mechanical or hydraulic systems. A limiting factor in the use of suction dredges, are the characteristics of the material to be suctioned

and consequently there is no control over the percentage of solids. On the other hand, the lack of knowledge of the reserves, is sometimes the reason for equipment to be in the wrong location, where material is abundant but with very low gold content. Finally, many times it happens that the engines have insufficient power and suction is inefficient; also, there is frequently an absence of preventive maintenance practice.

A second method is the chute system used in the foothills areas. In this method, extraction of material is carried out with front-end loaders that loosen the gravels from the upper parts of the terraces. The material is extracted and carried by the loader to the chute, which is comprised of a wooden bin 4 to 5 mts long, 3 mts wide and 3 mts high. The material is deposited and washed in the bin and then released onto a screen that eliminates the + 1/3" and the minus size falls to a sluice box for final recovery. The oversize sterile material is transported by the same loader and dumped at the lower parts of the gorge. A limitation in this process, is the lack of planning. Thus, the area where the sterile material is dumped, may be workable ground and access to this material will be difficult at a later date. The loader shovel is frequently overloaded, spilling material over the route which has to be graded later by the same loader causing additional wear on the tyres and wasted time. There are also preventive maintenance problems causing excessive costs in lubricants and contamination of the water.

There is no manual labour involved in these mechanized methods in any of the production stages. The loader extract the material and deposit it in the recovery plants such as, washing plants and the bucket dredges.

All the extraction methods described above use the same beneficiation systems, that is, gravity concentration. The gold bearing material passes through a 1/3" screen to classify it, the + 1/3" is discarded and the minus 1/3" goes to a sluice box for recuperation. The sluice box is basically an inclined trough lined with plastic, jute or channelled carpet. The gold particles are trapped on this lining, which is shaken at the end of the shift. The nuggets are separated and the fine material treated by amalgamation.

The main limitation with the sluice boxes, is that they are constructed empirically with no technical notion of parameters such as inclination, volume and turbidity of water, grain sizing and others. All these factors influence the gold recovery which is inefficient.

During amalgamation, excess mercury is used in order to accelerate the process. The mixture of gold sands and mercury is carried out in buckets with water and a detergent and mixed and rubbed by hand, sticks or mixers. The resultant black sand containing particles of amalgam, is separated from the rest of the material by panning in wooden pans at the river's edge and particles of amalgam are lost in the river during the process.

Once the amalgam is separated, it is squeezed in a cloth and a "button" is obtained, this is placed directly over fire to evaporate the mercury. This operation is called "refoguelo" (firing) and the product is "fired gold" which is sold to the gold traders.

3.2 Mid South

Description of the deposits

The gold deposits in the Ica, Ayacucho and Arequipa areas are primary deposits or veins contained in volcanic or sedimentary rocks. The composition of these veins is relatively simple, consisting of quartz and pyretic gold. The deposits in this zone, are divided into 6 main areas, from north to south. The area of Palpa and Nazca in Ica, include the Tulin, Saramarca, Angana, Santa Rosa and Quimbalete deposits amongst others.

The gold mining areas of Ayacucho are Huanca and Jaqui. The first includes the Huanca, Coca Cola and Lechera deposits. Jaqui is a larger area where the Santa Filomena, San Luis, Millonaria, Convento and Santa Rita deposits are found.

Arequipa has four mining areas: Chala, Chaparra and Caraveli, Ocoña and La Joya. The Chala area includes the Flor del Desierto, Francia, Orion, la Capitana, Mollehuaca deposits etc.

In the Chaparra and Caraveli area, the San Sivestre, Convento, Eugenia, Torrecillas, Sondor, Calpa, etc., deposits are located. Ocoña includes the Posoc, Clavelina, Cerros Ricos etc., deposits. Finally, the La Joya area includes the Yuracmayo, Palca and Qushuarani deposits and others.

Exploration, production and beneficiation

The gold deposits located in this zone are not attractive for mining companies, due to their reduced size. These deposits are composed of very thin veins that would require a costly program of sampling, surveying and chemical analysis, furthermore they probably require high investment for mine preparation that would make the project non profitable. However, the artisanal exploration method is highly selective and labour intensive and does not require major equipment.

Artisanal exploration is based on visual detection of gold veins and their gold content. A mineral sample is taken, ground and placed in a plate lined with black rubber called a “puruña”. By a series of rhythmic movements, the gold is separated by gravity and, according to the size and quantity of gold particles, an estimate is made of the content.

For the exploitation of these deposits, a selective mining system is employed called “circado”. In this system, manual drilling is used and the rock adjacent to the vein is blasted leaving the vein in its place. The vein is then carefully eased out onto a cloth spread on the floor. With this method, the miner obtains ore with an average of 0.6 oz of Au/ MT. If the vein were worked by conventional methods, depending on it’s width, grades would only be in the order of 0.2 ox Au/MT due to the dilution by the surrounding rock. It is necessary to emphasize, that this method has a low water consumption. Estimates indicate that 18 m3 of water are required to produce 1 kg of gold, whilst small formal mining requires about 300 m3. Also, the amount of sterile material is reduced which contributes to maintaining high grades, less water, explosives, reagents and energy are consumed.

In some of the deposits such as in Huanca, mechanized drilling methods are used such as electric drills (dry drilling) and conventional compressed air. The electric drills are personal tools and weigh about 6 kg and have a drilling capacity of 10 or 11 times the speed of hand drilling. These are used in deposits where the rock is not very hard. Compressors are used for deposits with hard rock and wider veins. The use of compressed air can accelerate the drilling rhythm by about 150 times and requires work with crews. Generally, the ore mined with compressed air, is sold directly to cyaniding plants.

A complementary operation to artisanal mining of deposits, is “pallaqueo” which is manual selection of material from mine dumps. Operations that have mechanized drilling, produce greater quantities of dumps as it is less selective. These dumps have certain amounts of gold content that can be recovered by the pallaqueo effected by women, children and old people.

The ore produced is treated first with the “quimbalete”, a rocking device made from two large rocks that grinds the ore and then this is treated with mercury to amalgamated the liberated gold. Once the gold is amalgamated, the mercury is recovered by filtering and is reused. The filtered amalgam is then fired to evaporate the mercury and free the gold. The final product is fired gold.

An amalgamation sub product, are the tailings from the quimbalete grinding process which still have a considerable gold content of 10 to 43 gms Au/MT that cannot be recovered by the artisanal miners. These tailings are sold by the quimbalete operators to the beneficiation plants in the zona (Vllachica, et al., 1994). The technology used by the plants to process these tailings, is cyaniding with pulp carbon (CIP). The final product is carbon impregnated with gold, which then requires processing in a refining plant to produce gold bars which can be sold on the metal markets.

3.3 Puno

Description of the deposits

The gold deposits in Puno are divided into primary and alluvial deposits. The deposits are veins and bedded structures. These are located in the higher parts of the eastern mountain range (5,200 m.a.s.l) and in the lower levels (700 m.a.s.l.). The Ananea block is the most important gold deposit in the department of Puno. It is made up of 19 quartz beds with 2 to 70 meters between beds and thickness of 2 to 40 cms. The beds contain quartz with native gold, pyrite, galena, clear blend, pyrrhotite, marcasite, chalcopyrite, molibdenite, arsenopyrite and tetrahedrite. The grades fluctuate between 0.6 and 0.7 ozs Au/MT, although a study made by IDESI found grades up to 6.81 oz Au/mt³ (Lazaro et al., 1995a).

The alluvial deposits, mainly placers, are located at the commencement of the altiplano of the Eastern Mountain Range, on the lower eastern flanks of this range and in the riverbeds of the Tambopata and Inambari basins. The most important deposits are, the morrain of the San Antonio de Poto mountain, part of the fluvio-glacial frontal morrain of Islapampa, the depression of Pampa Blanca and the placers of the river Pacchani basin (Lazaro et al., 1995a). 1995a). The average grades of the alluvial deposits fluctuate between 200 and 300 mg. Au/mt.³.

Exploration, exploitation and beneficiation

In the primary deposits, exploitation is by means of addits following the quartz veins. Small tunnels are driven of barely 0.70 x 0.70 mts. Work is disorderly with varying gradients and directions. Because of this, mine workings are affected by flooding. Similarly, following the veins makes the addits very irregular, sometimes causing two or more workings to intercept each other with consequent danger of cavings. Work is mainly manual, excavating with picks and drill rods, explosives and sometimes compressors.

In the alluvial deposits, production is by several methods. Monitoring with high-pressure jets of water from 6" monitors that disintegrate the sediments and dragging them to an iron sluice box. The sluice box has rifles to recover the gold and other heavy minerals. The problem with this method, is that the jet has to be very powerful which is obtainable only during the rainy season. Also, only the higher parts of the terraces can be worked in order to remove the sterile material by gravity.

The channel method consists of caving the terraces with steel bars. The gold bearing material is washed and deviated into ditches. The gold and other heavy materials are deposited on the bottom of the channel and are gathered ever week, biweekly or monthly. This method is seasonal and used in the rainy season due to the high water demand.

The "cochazos" method is by the manual excavation of underground rooms and pillars at the base of the alluvial, and with the aid of explosives, produce the caving of these workings. The material is pushed into channels where it is rapidly washed and transported by large volumes of water. The gold remains at the bottom of the stone lined channel. This method requires large volumes of water and can be employed only during the rainy season, it also requires abundant labour.

The alluvial deposits also require tunnelling, where the material is extracted by wheelbarrows and washed in the streams. This method has many safety problems as no propping is employed.

The shaft method to extract material from the riverbed is effected by excavating shafts at the riverside to obtain access to the river gravels where gold is concentrated. The material is extracted with shovels and wheelbarrows and washed in sluice boxes on the surface. As the workings are in the river gravels, pumps must be employed to drain the water that filters from the river.

Finally, "hichiqueo" or panning is carried out individually. The miner utilizes a wooden or metallic pan to separate the gold from the sands. Generally, this method is employed with the tailings of the other methods described.

Ore beneficiation from primary deposits starts with crushing with small sledgehammers. The crushed material is then ground with the "quimbaletes" (rocking grinders) where mercury is added (approximately 500 gms of mercury for 10 to 20 gms of gold). The amalgam obtained is squeezed through a cloth in a pan to recover the excess mercury and

recover the Hg-Au amalgam. The button is then burnt to evaporate the mercury and recover the gold to produce “burnt gold”. In La Rinconada and Cerro Lunar areas, there are approximately 1,000 “quimbaletes” and some contractors rent them at S/.10 per day.

The problem of beneficiation with the use of “quimbaletes”, is that gold recovery is low (about 50%) and highly contaminating for the miners and the environment. Additionally, the quantity of mercury used is excessive and a good part of it is lost during the grinding. The contaminated tailings are not deposited in pits or other deposits and consequently the mercury is dispersed constantly. Amalgam burning is done in the houses of the miners with the consequent damage to their health.

Beneficiation of material from the alluvial deposits, is done principally by gravity methods. The heavy sediments trapped by the rifles or cobble stones in the sluice boxes are gathered or harvested every week, two weeks or monthly. With the cobblestones, each stone is carefully washed and the nuggets are picked out during the harvest of the concentrate. The concentrate is processed by panning where gold is recovered (generally above 1 mm). As the gold particles are clearly visible, less mercury is employed than in the recovery of primary gold.

Due to the excessive use of water, gold recovery by these methods is low (about 60%). Monitoring produces too much turbulence, which drags large and small grains. With the channel system, the gold particles bury themselves in the bottom of the sands. The use of mercury produces the same negative effects to the environment and the health of the miners.

3.4 La Libertad

Description of the deposits

In the Pataz area, there are two types of gold deposits: primary and alluvial. The primary deposits are in the form of veins with generally gold bearing sulphides. The common ore is pyrite; however there are also oxidized ores that have a higher value. The average grade of this zone is about 0.6 oz Au/MT. These deposits are in the Culpuy zone and in the mining districts of Parcoy and Buldibuyo.

The alluvial deposits are not of major importance and are on the borders of the rivers Marañon and Cajas. The inhabitants of the area occasionally wash the gold bearing gravels.

Exploration, exploitation and beneficiation

The same as in other zones, exploration is carried out empirically. In the primary deposits, visual inspection is made of the outcrops of the oxidized structures. The tunnels of abandoned mines are also explored. Alluvial deposits are sampled with shovels and pans on the shores of the river Marañon and its tributaries.

The primary deposits are worked principally with addicts that follow the high-grade mineralised zones. The ore is extracted manually (hand drills and sledge hammer) or with

explosives. The ore is carried out to the surface (capacheo) and is crushed by sledgehammer to reduce the size to facilitate its transport to the place of beneficiation.

Another production procedure is the extraction of bridges left in the addits of old abandoned workings.

Beneficiation of primary ore is by crushing with sledgehammers and grinding with stone mills. During the grinding, water and mercury are added to obtain amalgam. The amalgam is squeezed through a cloth and then fired to obtain fired gold, which is sold to the merchants. The tailings left from the grinding are saved and sold to the local concentrating plants. Due to the presence of oxidized ores, small cyaniding plants have been built in the area.

4 Environmental impact by artisanal mining

One of the principle negative impacts of mining in general, is on the environment. The considerable amounts of earth moving caused by the extraction of mineral resources, alters the topology of the zone being exploited. Additionally, the processes of ore beneficiation, produce extremely toxic residues from the consumables used and by the chemical substances released from the process. The concentration of these residues, causes a negative effect on the environment, which ends up producing grave consequences for the ecosystems, and eventually on human health. Fortunately, the changes of technology in the sector have permitted the creation or modification of the existing mining techniques that permit a reduction in the environmental impacts. Additionally, the design of environmental management systems, allow for the use of certain practices that assist the prevention and/or contamination control.

Unfortunately, these technological advances are not accessible to artisanal miners. In the first place, there is a total lack of information for the artisanal miners on appropriate technology and technical parameters that can lead to a decrease of environmental impacts. An example of this, is the ignorance on methods such as cyaniding as an alternative for processing gold bearing material and the technical parameters that can make amalgamation more efficient. Furthermore, alternative technology requires an investment that is too high for these miners, either in terms of apprenticeship or financial resources. In the case of adoption of new techniques, these have had to be promoted by the government or other types of institutions. Even so, as can be seen further on, the results can remain in the form of knowledge of the alternatives, but not in their utilization. Third, ignorance of the connection between the deterioration of the environment and human health, has it that the miners obviate the necessity of an adequate environmental control. For example, a mercury spill occurred in an important mine in the year 2000 that provoked the contamination and hospitalisation of several inhabitants and, the indemnity of the victims; news of the case reached the artisanal miners of the mid south and other mining centres, where at last they realized the danger of direct mercury handling.¹¹

¹¹ Testimony of an artisanal miner from the Mid South expressed at a workshop of artisanal miners organized by GRADE in July 2001.

4.2 Mercury contamination

Mercury contamination is the principle environmental problem brought about by artisanal mining. The indiscriminate and inefficient use of mercury for gold amalgamation, have been the cause of large quantities being lost and introduced into the environment in liquid form or in the form of gasses. It is estimated that 70 tons a year are lost of liquid mercury in the Mid South and another 15 tons in the Puno area (Mosquera, Trillo and Lujan, 1999).

Table 1 Mollehuaca: Environmental exposure of the population to mercury (February, 1996)

Places	Mercury concentrations (ug Hg/Mt 3 of air)	
	Results	Recommended limit
Committee 1	3.412	10
Committee 2	16.6614	10
Committees 3-4	9.7334	10
Committees 5-6	3.859	10
Committees 7-8	56.288	10

Source: General Direction of Environmental Health (1996). " Report on the evaluation study made on workers of artisanal mining in gold production at Mollehuaca, Caraveli, Arequipa," mimeo. DIGESA – Ministry of Health. Lima.

The loss of liquid mercury is produced principally during the amalgamation of gold¹². As mentioned in the previous section, gold amalgamation is effected in the quimbaletes. Once the gold has been separated, the liquid solution that remains with the tailing contains a high concentration of mercury and gold (0.4 to 1.2 ozs of Au/MT). The content will be higher of the mercury is recycled as it loses it's capacity to amalgamate. When the tailings are disposed of, the evaporation of the water leaves the mercury attached to the sterile material. If the tailing is not processed later, or if it is kept until a later processing, the tailing percolates through the area where it is stored, with the danger that during its filtration it will contaminate a water flow. On the other hand, water evaporation and wind action, causes dust particles with mercury contents to be liberated into the atmosphere. This explains why high mercury concentrations have been found even in areas far from the centres of mining processes. **Table 6** shows that there are areas in Mollehuaca that give mercury concentrations far in excess of the limits recommended by the World Health Organization.

The prevalent high temperatures in the Mid South (25deg.C to 30 deg. C), favour the increase and permanence of mercury in a state of vapour, but fortunately the air circulation

¹² Depending on the mineral characteristics, it can be ground directly by the quimbalete and mercury may be added later for it's amalgamation. In these cases, frequently found in the Puno area, mercury contamination occurs from the grinding stage.

which varies from 4 to 7 mts/sec., avoid an increase in mercury concentration in the air (General Direction of Environmental health, 1996).

Contamination with mercury vapours occur during the burning process. It is estimated that 20 tons of mercury are liberated each year: In the mid south 10 tons and 10 tons from the Puno area. It is also known that 50% of the liberated mercury, precipitates in the area surrounding the place where it was burnt. Taking into account that this operation takes place in the house of the miner, the shopkeeper, the gold purchaser or owner of the quimbaleta, it is not difficult to imagine the danger that the inhabitants of the house are exposed to. In fact, in different studies made, high levels of mercury have been found in the blood of the members of the families that inhabit the houses where mercury is burnt.

It can be seen from the above, that the total loss of mercury per year is in the order of 105 tons. The principle areas affected by this type of contamination, are the basins of the rivers Grande, Acari, Yauca, Chala, Chaparra, Atico Caraveli, and Ocoña in the Mid South, whilst in the Puno area, contamination is concentrated in the river Carabay basin.

It is important to emphasize that the Ministry of Energy and Mines and some non-government organizations, have been promoting the use of retorts to maximize mercury recuperation during the burning process. Despite the demonstration campaigns that have been effected, and the distribution of retorts in different mining communities, their use has not been extended. One of the reasons miners do not wish to use these artefacts, is purely economic, burnt gold acquires a different colour which has an influence on the prices received by them. Another reason is cultural, miners do not trust the retorts and believe that part of the gold remains trapped in the retort. Even less success has been achieved with the promotion of communal retorts as a measure to reduce contamination and increase efficiency in the burning of mercury. The lack of confidence on the part of the artisanal miner is the main obstacle for this practise.

4.2 Effects on soil

Earth movements made in the process of ore extraction can be a serious problem due to the topographic alteration of an area and it's capacity to regenerate the flora and fauna.

In Madre de Dios for example, artisanal mining has caused an alarming increase in erosion due to the cutting and burning of forests, as also the large volumes of earth moving made in order to exploit the gold placers. In operations where heavy equipment is used, the earth is compacted in such a manner that vegetation no longer grows, apart from the damage caused by contamination from lubricants and fuels. Furthermore, the dumps produced through treatment of the gold gravels, reduce the capacity of the soil to retain humidity and impede the growth of vegetation.

In Puno, in the ecosystems of Rinconada, Cerro Lunar and Ananea, a great movement of material on the flanks of the mountains and in the river courses can be observed. This is contributing to erosion and the consequent dangers of landslides, sedimentation in the rivers and the disappearance of marshes that were before, pasture land and havens for wild birds. The increase in population has also caused agricultural land to be overworked. The disposal of garbage and chemical substances contaminate the soil. Although it is true that

the soil upon receiving toxic materials, can stabilize them and render them harmless, this capacity has a limit.

In the Mid South and La Libertad zones, mining generates little soil contamination. Contrary to other areas where earth movement causes erosion, artisanal mining in the Mid South does not require earth movement as the miners perform selective mining where the volume of sterile material is limited. In areas where there is more mechanization for mine working, such as Huanca where compressors are used, larger amounts of dumps are produced and as fuels are used, there can be spills of chemical substances. At La Libertad, artisanal mining has a limited effect on the soil, as their earth movement is reduced and consequently the accumulation of mine dumps is small. Although it is important to mention, this does accumulate on the riverbanks. The constant use of some routes from the mining camps to the workings, increases the erosion. On the other hand, the garbage produced by the mining camps, does have a pronounced negative effect as it contains chemical products that are absorbed into the soil.

4.3 Contamination of waterways

The contamination of waterways is more evident in the areas of alluvial deposits as gravel washing requires large quantities of water. In Madre de Dios for example, washing in sluice boxes increase the turbulence in the rivers. This turbidity is due to the large quantity of fines in suspension that travel long distances before they settle. The urbid water prevents the sun's rays from reaching the bottom of the river, which prevents the development of plankton and other aquatic plants, it also makes difficult the diffusion of oxygen molecules in the gills of the fish. Something similar occurs in the Ananea area (Puno) with the exploitation of morrains.

Despite the fact that alluvial deposits are beneficiated by gravity methods, there are occasions in which mercury is used for gold recovery in fine material. Amalgamation and panning is carried out at the river edges with mercury losses that end up contaminating them. Liquid mercury in water transforms into a series of highly toxic compounds that contaminate the creatures that live in the rivers such as fish, which in turn may contaminate humans. Similarly, when mercury is evaporated by the process of firing, the molecules suspended in the atmosphere are precipitated by rainfall and end up in the rivers and follow the same process of transformation as liquid mercury.

The use of lubricants and fuels in mechanized operations as in Madre de Dios, where there is little maintenance and deficient handling and elimination practices, cause these chemical substances to be used in excess and spill on the ground and the rivers. Rainfall contributes to wash these elements into the rivers.

Contamination of rivers in the Mid South is limited. However, there are zones such as Otoca where the quimbaletes are located along the river edge and the tailings are dragged into the river during the rainy season.

Something similar occurs in Chala and Atico where the quimbaletes are only 100 meters from the sea. As there is a shortage of water in the Mid South, frequently agriculture

becomes the transmission media for contamination to man. The extreme case is Caraveli, where quimabeltes are installed in agricultural plots to take advantage of the water.

4.4 Effects on the ecosystem

Artisanal mining has adverse effects on watercourses and also has a series of repercussions on the ecosystem. In Madre de Dios, where the effects are more obvious, the disappearance of natural forests and the consequent erosion, generates an extremely negative impact on the living species in the area. Apart from the disappearance of the flora and the noise generated by mechanized operations, the animals that inhabit these forests have to migrate to areas where there is no mining activity, limiting in this manner their capacity of survival. In the second place, the accelerated rhythm of erosion prevents the regeneration of the ecosystem. Thus the effect of rain that could drag organic material to cover the eroded areas, is limited by the grade of erosion produced. Third, the excessive turbidity of the rivers limits the aquatic plant life that sustains the animal species that migrate to clear waters. Fourth, water contamination by mercury and other chemical contaminants are absorbed by the living species, and even if they migrate to cleaner waters, they take mercury in their bodies. An example is with fish that tend to go upstream, and where they can be consumed by people that have nothing to do with mining, can be affected by the mercury contamination.

In Puno also, the decrease in vegetation on the borders of the rivers Inambari and Tambopata can be observed. In these areas, firewood and charcoal are obtained for domestic use and for burning amalgam. The vegetation is also affected by the opening of mine addits and the construction of channels for gold recovery. Additionally, the discharge of chemical substances into the waters and soil where animals feed and drink, are also contaminated. In this respect, some camelids (an important source of protein for the inhabitants), feed in the marshlands contaminated by mercury and other chemicals, can transmit these contaminants to man. The same occurs with fish in the lower reaches of the rivers Inambari, Tambopata and Chinchipe.

At La Libertad, the ecosystem is affected basically by the accumulation of mine dumps on the areas covered by vegetation, which prevents their future growth. Similarly, the use of firewood for firing amalgam is deteriorating the small neighbouring forests. Finally, the miners in the Retamas area use a species of berry to accelerate the process of amalgamation. The intensive use of these berries has a negative impact on the vegetation as their reproductive capacity has been considerably diminished.

Due to the desert characteristic of the Mid South, it is the area that has been least affected in its ecosystem. The vegetation is limited to cactus and a spiny leguminous plant that is found close to the seasonal rivers. The fauna is typical of desert zones, insects and arachnids, reptiles and rodents. Due to the scarcity of rain, acid drainage is limited and consequently the contamination of the flora and fauna is also limited.

4.5 Effects on climate

The attraction of population to the artisanal mining centres, produces a disproportionate growth of these. With those townships in the province of Dan Antonio de Putina, the

increased population in the areas close to the snows, is producing an intense and continuous melting process. Additionally, garbage burning (product of a larger population) and of hydrocarbons (product of mining activity) is worsening this situation by increasing the carbon monoxide in the atmosphere, which contributes even more to its heating (Lazaro et al, 1995a).

5 Occupational Health and Safety of the Artisanal Miner

Although artisanal mining gives an opportunity to 20,000 to 30,000 persons to make a living, it is also true that by working in this activity can signify exposure to irreparable health deterioration and eventually accidents that may result fatal.

5.1 Mining Safety

The lack of resources, ignorance or non compliance with safety regulations, the lack of information and insufficient equipment for artisanal mining, have an influence on the probabilities of work accidents being high. In Peru, there is not an appropriate accident register in artisanal mines, so it is not possible to give an estimate of these.

It is known from international studies, that the five principle causes of accidents in small mines are: (a) rock falls and cavings (b) lack of ventilation (c) mal use of explosives (d) lack of knowledge, lack of information and infringement of regulations (e) use of old equipment and deficient maintenance (International Labour Organization 1999).

In fact, artisanal miners are exposed to each of these dangers, especially those that work underground. The tunnels they drive to reach the veins are very narrow (0.70 x 0.70 mts) and do not follow a determined plan, but go in different directions and gradients. The narrow tunnels make ventilation deficient. If explosives are used, the possibility of the miner exiting before the explosion takes place is reduced. The different directions taken by the tunnels, apart from making ore extraction difficult, can produce fracturing of the mine structures and end up in cavings. If to these factors we add, that the majority of the miners do not use safety appliances such as hard hats, steel pointed boots amongst others, the possibilities of fatal accidents are enormous.

In the case of alluvial deposits, working morrains or placers with monitors, can produce land slides, and as frequently, the water pressure of the monitors is insufficient to move the material, this obliges the miner to get too close to the working front and increase the possibility of being caught by a slide. On the other hand, those working the beaches and riverbeds, the diver is exposed to the danger of being buried by cavings under the water. Also the lack of adequate maintenance of equipment such as compressors, can result in particles of oil in the oxygen going to the divers.

The possibilities of an accident being fatal, grow with the little accessibility to centres that have medical attention available. As mentioned before, the mining communities only have health centres for primary medical attention, but do not have the instruments to attend a serious accident. In the majority of cases, the difficult access to mining centres, makes it

practically impossible to transport an injured person to a better-equipped health centre, frequently causing irreparable damage.

5.2 Occupational Health of the Artisanal Miner

According to a report by the International Labour Organization (OIT), the five principle health risks in small scale mining operations are: (a) exposure to dust (pneumoconiosis); (b) exposure to mercury and other chemicals; (c) effects of noise and vibration; (d) effects of deficient ventilation; and (e) effects of excessive effort, insufficient work space and inappropriate equipment (International Labour Organization, 1999).

The few studies that exist on occupational health of artisanal miners in Peru, confirm the above mentioned risks. In underground operations, the miners are exposed to dust during the drilling operations and ore loosening. In areas such as the Mid South where these operations are abundant, there is a high incidence of chronic respiratory illness such as bronchial and pneumoconiosis affections. This last, is the most frequent when mechanized drilling methods are used. The fact that little water is used, increases the amount of dust particles suspended in the air. In the other case, the operations in Ananea where the people are exposed to permanent contact with melting waters and low temperatures, bronchial and rheumatic affections are common.

In beneficiation work, the principle danger is the contact with and inhalation of mercury. The risk of poisoning not only affects the artisanal miner or the quimbalete operators, but as explained earlier, there are great external effects as the mercury is burnt in the homes and affect the other members of the family. A study made in the Mollehuaca community, revealed that 62% of the 102 people studied, had mercury values exceeding the normal values (General Direction of Environmental Health, 1996). **Table 7**, shows the mercury concentrations registered at the quimbalete operations in different work locations in Mollehuaca. It can be seen that the mercury concentrations exceed the maximum permissible limits in all the work locations. In these mining communities of the Mid South, it is common to find chronic symptoms such as high sensitivity to light, bleeding gums, colics, vomiting, kidney and urethra pains. Also, people are found who, after prolonged exposure to mercury, suffer from convulsions, have difficulty in talking and lack concentration.

Table 2 Mollehuaca: Occupational exposure to mercury (February 1996)

Committees	Place of work	Mercury concentrations (mg. Hg/m ³ air)	
		Results	Permissible limit
Committee 1	Quimbalete	0.01297	0.01
Committee 2	Quimbalete	1.0264	0.01
Committees 3-4	Quimbalete	0.04498	0.01
Committee 5	Quimbalete	1.0807	0.01
Committee 6	Quimbalete	0.034	0.01
Committee 7	Quimbalete	0.02577	0.01
Committee 8	Quimbalete	0.02773	0.01

Source: General Direction of Environmental Health (1996). "Report on the evaluation study made on workers of artisanal mining in gold extraction in Mollehuaca, Caraveli, Arequipa," mimeo DIGESA – Ministry of Health, Lima.

6 Child labour¹³

Child labour is common in artisanal mining areas. The main causes that oblige children to work in mining activities are, first, the parent's income is not sufficient to cover the family needs. The low income levels of artisanal miners and their consequent lack of saving capacity, does not allow for an improvement in their economic situation in a medium or long term period. Secondly, the mining families conserve cultural patterns that justify child labour, especially in the areas where migrant labour from agricultural communities is concentrated. Finally, mining communities rarely have adequate educational infrastructure, which favours the availability of children for work (COOPERATION, 2000).

It is estimated that 50,000 children work in mining activities, covering almost all of the mining phases (Piazza, 2000). In drilling, either mechanical or manual, children between 12 and 14 years old, help to drill the holes in surface mining. Children prepare the explosives for blasting. After blasting, children bring out the sterile rock and, 8 year olds bring out the ore. Later, they assist the women in sorting ore out of the dumps. Children also bring out selected ore from the mine, 12 year olds carry a 35 kg can and less than 12 year olds carry a half can. They also help with the ore classification and the crushing. From 11 or 12 years old, children fill cans with crushed ore. Children also participate in grinding and amalgamation with quimbaletes and mills, working in shifts that vary from 1 to 8 hours. They also discharge the tailings from the quimbaleta. Although children do not actually do the amalgam burning, they accompany their parents in this work. Finally, it is also possible to find children selling gold found by them in the sorting process (COOPERATION, 1999a).

As is to be expected, the children who participate in almost all the phases of mining, are also exposed to the same occupational affections as the adults, aggravated by the fact that their bodies are still in the process of growing. Several of the activities they carry out, such as moving rock or ore, require efforts in excess of those of a child's capacity, causing serious ergonomic damage that is manifested by, pains in the back, knees, elbows, shoulders and wrists amongst others.

Some figures that were registered on the most common cases attended by the health centre at Laberinto in Madre de Dios, gave the following: 28% for acute respiratory infection, 21.% for acute diarrhoea infection, 24.4% for skin diseases and 15% for wounds and fractures¹⁴. And, at Huanca during 2000, they registered, 37% acute respiratory infections, 28% skin diseases, , 26% intestinal sickness, 4% wounds, 2% burns and 1% tuberculosis. To these figures it is necessary to add, anaemia and malnutrition that affects these children, which puts in peril their physical and mental development.

¹³ This section is based principally on the following: (COOPERATION, 1999a; Piazza 2000)

¹⁴ 168 cases were attended of children between the ages of 6 to 17.

Finally, children are also exposed to mercury. In Santa Filomena, it was found that 6 of the 11 children analysed had mercury concentrations in their urine of between 40 and 90 ug per litre (COOPERATION, 2000).

A direct consequence of children's participation in mine work, is the low rate of schooling that is aggravated by the lack of adequate educational infrastructure in mining communities. Also, children that study and work at the same time, have a low scholastic yield, either because they have little time to study at home, they are too tired or they miss classes. The principle repercussion of low scholastic yield and, in some extreme cases desertion from school, is the limitation for future employment possibilities and their survival. Over a long term, they will form part of a poorly qualified labour force with low productivity levels. This will prevent them from forming part of a labour market and end up perpetuating the poverty cycle they live in.

7 Organization of Artisanal Miners

The artisanal miners, recognize that their lack of organization is one their main problems and that it has a negative impact on their future development possibilities¹⁵. They recognize that working concessions that belong to others, or in a free area, if they do not have property rights, this places them in a very weak situation. They know that to continue their work, they must establish an agreement with the titleholders of the concession or, they must act according to the "law of the jungle". They also know that their individual position is weak and that they must unite in order to improve their negotiating capacity.

The organizational problem of the artisanal miners should be seen from two points of view. On one hand, from the point of view of mine work organization which has to do with the manner in which miners fit into the chain of mining values. On the other, social organization with the objective of taking actions that will improve the standard of living in their communities.

7.1 Organization

As can be seen in **Illustration 1**, the typical chain of mining value in the Mid South, starts with the extraction of gold bearing material, which is effected by the totality of artisanal miners. About 90% of the ore is taken to the mills and quimbaletes, where the beneficiation process commences. Part of the ore may be put aside for payment to the concession titleholders, if this is the agreement between parts. The owners of the quimbaletes, frequently act as financiers of working capital for the miners, with cash or in species (food, water, explosives etc.). Once the amalgam is obtained and it's subsequent firing, the miner sells the gold to the different buyers in the area. The tailings produced by the beneficiation process, which has high gold and mercury content, is kept by the owner of the quimbalete, who later sells it to the cyaniding plants.

¹⁵ Idea brought forward at the Artisanal Miners Workshop organized by GRADE in Nasca, July 2001

As can be seen, the miner has to make two payments, either in cash or in ore, to the concession titleholder and to the owner of the quimbaleta. At the same time, he receives nothing from the sale of the tailings.

Only a small part of the miners sell their ore directly to the metallurgical plants. This alternative is not exempt from losses to the miner, as frequently, the plants do not pay a just price for the ore.

Although the scheme described above reflects the reality in the Mid South, in other mining areas there are also unfavourable situations for the miners. In Puno for example, miners are accustomed to work with a system known as “cachorro”, whereby there is an agreement with the contractor to work the mine, and in payment for his work he is allowed to extract the ore for himself for two or three days a month. This is a form of over-exploitation as the miners will work much harder during those days and oblige their family to help them. With regards to the sale of gold in Puno, this is done in an informal manner.

The buyers do not give sales liquidation slips. Part of the gold is paid in species such as food or other consumables. The majority of the buyers are breaking the law by not registering with the Public Mining Register. Gold transactions are subject to payment of the General Sales Tax, but this increases the cost. In order to avoid this payment, the gold sold figures as gold for export which is exempt from this tax.

In Madre de Dios, the miners work under the system of “enganche”. Under this system, miners are hired verbally by the contractors in their place of origin and transported to the mine. In order to avoid the miners changing jobs after arriving at the mine and the contractor losing his investment, hiring is done with a work contract for three months and payment comes at the end of that period.

Finally, in La Libertad, part of the miners work in the concessions belonging to La Poderosa Mining Company who buys the ore produced by them. The Company charges Treatment Charges that apparently are excessive and it has been estimated that the company undervalues the gold content in about 50%. For this reason, almost 80% of the artisanal miners process their ore independently. Another section of the miners work in areas not exploited by the Company and sell their production to the ore buyers. The Company does not worry over this illegal production, as they know that the miners are unable to excavate deep tunnels and that the company will eventually work these areas with heavy equipment. Finally, there are small miners that have their own claims which they work themselves or hire workers.

All of these situations demonstrate the weak position of the mineworker in the chain of values, which perpetuates his poverty and causes the necessity for the members of his family to work in mining activities. Maintaining this scheme of things, limits the possibilities of the young generations in aspiring for a better life.

7.2 Social organization of Miners

The informal situation in which many miners are working, has originated a series of initiatives, either theirs or backed by the government and other institutions, to create

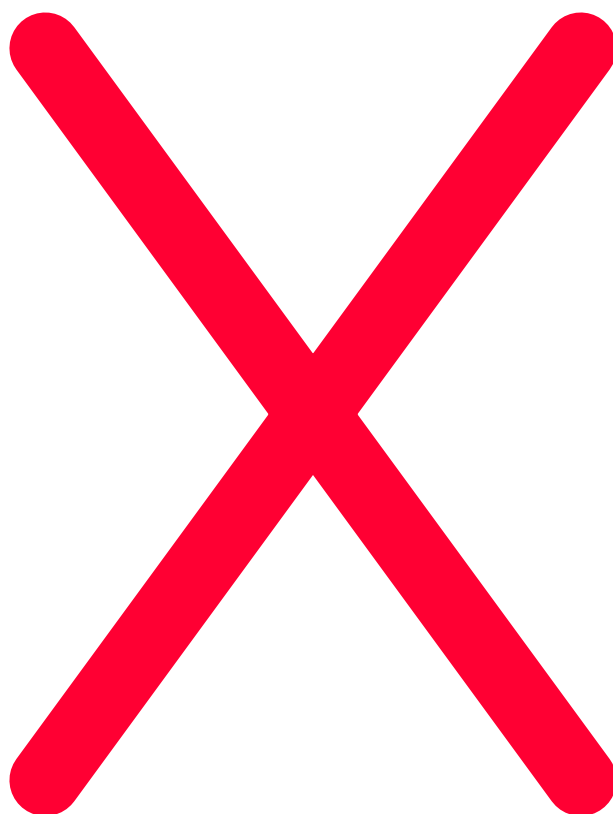
organizations to represent them and allow them to express their necessities and demand their rights. The creation of these organizations required patient work to overcome the natural distrust and individualism of the artisanal miner. It has also required and still requires, the training for them to understand such an organization, what is the form of organization that best suits them and what are the benefits gained by forming part of one; as also the capacity and duties that have to be assumed in order that the organization functions efficiently.

The favourable results of the artisanal miner organizations that have become cooperatives in Puno and companies in the Mid South, are shown by the improved conditions obtained in agreements with concession titleholders, and in obtaining their own concessions.

Furthermore, some organized groups have managed to attract the attention of institutions, that back them with development programs and solve priority problems such as, health, education, nutrition for their children, training for the women, and infrastructure for their communities amongst others. This has incentivized other mining communities to follow in their footsteps.

However, when the interest in associating is based simply on obtaining benefits without accepting obligations, a problem presents itself that has to be worked on. A common complaint amongst mining leaders, is that their members do not give them sufficient support. These leaders know that they have a responsibility towards the people they represent, but the expenses involved with this work are absorbed directly by them, as the associates do not help to cover them¹⁶. Prolonging this type of situation, endangers the effectiveness of these organizations because, on the one hand the leaders wear out which may cause them to abandon their role, and on the other, the idea that leadership signifies only expenses, could degenerate to a passive attitude amongst the miners, and an indefinite permanence of the present leaders, could eventually lead to situations of corruption.

¹⁶ Statement made by a mining leader in the Artisanal Miners workshop organized by GRADE, Nazca, July 2001



The two most organized mining zones are, Mid South and Puno. In the first, the artisanal miners have chosen the option to file for their own concessions. For this purpose, they have created companies such as, Comunidad Minera Mollehuaca S.A., created in 1994 and has 268 shareholders. At present it is the titleholder of a beneficiation concession and 5 mine concessions with a total of 2,400 hectares. This company has a cyaniding plant with a capacity of 20 MT/day that was built with the help of the Canadian and Japanese Technical

Cooperation agencies. The company also has an explosives magazine. Unfortunately, due to certain interests, the plant is at a standstill.

Another example is Santa Filomena that created the company SOTRAMI (Sociedad de Trabajadores Mineros S.A) in 1992 with 235 partners. This company is the titleholder of a production concession of 1,000 hectares. The partners of SOTRAMI have a license for the use of explosives and comply with the requirements for environmental evaluation. In Huanca, in 1996 a company was formed, called Sociedad de Mineros Artesanales, in order to negotiate with the titleholder of 5 filings in the area. The company was disarticulated due to a problem of embezzlement. At a later date, the company Huanca Comunidad Minera S.A. was formed with the help of a non-government organization. This company is negotiating with the titleholder of the filings.

The other mining settlements in the Mid South require training and assistance for their organization. In a recent workshop organized by GRADE¹⁷, the participating miners whose areas have no form of organizations, asked the representatives of organized communities, regarding their process of legalization. In like manner, when they became aware of the assistance received from different non-government organizations, they inquired how could they attract them to their respective communities.

In Puno, the miners from Ananea are organized in the form of cooperatives (see Table 8), which are grouped within the Central de Cooperativas Mineras de San Antonio de Poto (CECOMSAP. This centralized group has four concessions that were transferred to them by the Peruvian State mining agency Minero Peru. The cost of membership of a cooperative is approximately US\$300, so the candidates for membership work as labourers in La Rinconada. The monthly income of the members is in the order of us\$200, of which us\$120 go to the member and the rest remains with the cooperative to cover mining costs.

Table 8 Minino cooperatives at Ananea

Name of cooperative	No. Of members
Coop. Minera "Santiago de Ananea"	70
Coop. Minera "San Juan de Dios de Pampa Blanca"	35
Coop. Minera "El Dorado"	12
Coop. Minera "Halcón de Oro"	40
Coop. Minera "Señor de Ananea"	42

Source: Ministry of Energy and Mines

The Empresa Minera Ananea and about 150-200 individual contractors operate in La Rinconada. Miners are contracted by the contractors under the system of "cachorro". By this system, the miner is paid by the contractor by allowing him to extract mineral for himself for 3 or 4 days, as payment for 25 days work. As a result of the "cachorro", women

¹⁷ The workshop was one of the activities organized within the Mining, Minerals and Sustainable Development, under the leadership of The International Institute for the Environment and Development from London.

and children work searching for gold outside the addit (pallaqueo or llampeo), they wash the ore (chichiquean) and process it with the quimbaletes. They make about us\$8 per gram of gold. Children also work underground in very narrow tunnels.

Miners sometimes work for two or three contractors. **Table 9** shows the different contractor's associations in La Rinconada. A miner can make an average of us\$170 per shift ? (Month ?).

The objective of the associations of "Pallaqueras" and "Llamperos" is that the contractors permit women and elderly men who can no longer work as labourers, to work for them. These "pallaqueras" and "llamperos" pay between 7 and 8 Soles to allow them to work.

Table 9 Contractors associations in La Rinconada

Nombre de Asociación	No. de socios	No. de trabajadores
Coop. Minera "San Francisco de Rinconada" Ltda..	54	3,500
Asoc. de Contratistas Cerro San Francisco (Cía.)	15	800
Asoc. de Contratistas Cerro Lunar (Cía.)	120	2,500
Coop. Minera "San Francisco de Rinconada" (Dpto. de Acopio)	55	
Asoc. Of Women dump searchers (Pallaqueo)	200	
Asoc. Of Chichiqueros	100	
Asoc. Of Pallaqueras del Cerro San Andrés	100	
Independents (Lamperos)	200	
TOTAL	844	6,800

Source: Ministry of Energy and Mines

In Madre de Dios, after the intervention of the Ministry of Energy and Mines with the MAPEM (Artisanal and Small Mining) project, there have been important steps taken towards the legalization of the activity. **Table 10** shows the mining rights awarded to March 2000 in the different mining areas. More than 75% have titles and about 18% are in process and the rest have been abandoned.

Table 10 Minino rights awarded in Madre de Dios

	No. Of Minimum Rights
Puerto Arturo (Río Madre de Dios)	7
El Pilar (Río Madre de Dios)	6
Tres Islas (Río Madre de Dios)	79
San Jacinto (Río Madre de Dios)	46
Boca Inambari (Río Madre de Dios)	5
Shiringazoa (Río Madre de Dios)	23
San José de Karene (Río Colorado)	48
Puerto Luz (Río Colorado)	10
Barranco Chico (Río Puquiri)	32
Valle Santiago (Río Inambari)	12

Despite the progress in acquiring legality of operations, the workers organizations have not shown much advance, on the contrary they continue to work for others, either for titleholders or for “guests” who are contractors with equipment and work in concessions in exchange for paying the royalties.

8 Public Policy and the Legality of Artisanal Mining Operations

As has been referred to repeatedly, a characteristic that is shared by the majority of the artisanal miner settlements in the world, is the notable level of informality. This marginal activity can be seen, on the one hand, as one of the principle attractions of artisanal mining as it is an economic activity without barriers at the moment of entry, and one in which anybody can participate. People of scarce resources and human capital can find a daily subsistence in this type of mining. On the other hand, the informality has great limitations as it obliges the miners to interchange relations that are disadvantageous and also violent situations that endanger their physical integrity and that of their families.

Informality in artisanal mining has a negative social impact. An immediate effect, is that the government cannot count on revenues that can be later transferred to improve living conditions for the miners themselves. But perhaps the greatest danger, is the intense and high level of contamination that it generates (Chaparro, 2000), and that it reduces the possibilities of the mining settlements to reach a sustainable development. The informal miners who are not owners of the deposits they exploit, have no major interest in conserving and protecting the areas where they work, until the high levels of contamination reached, become a danger to them.

If the deficiencies incurred in the exploitation of these deposits are evaluated, not only do they produce economic effects, but they can also generate grave social problems. Chaparro 2000, indicates that the rudimentary exploration methods employed by the artisanal or informal miners, if not supervised by the government authorities, can lead to false expectations, which lead to an invasion of the mining areas. This can cause that people of very low income, leave their places of origin with the illusion of a better life that may never come or, it can also generate situations of violence, where individuals with more resources try to expel the weaker settlers. In similar manner, the emphasis given to ore extraction in the production phase, without any investment for the improvement of the deposit, limits the possibilities of the miners to save and participate in the other mining phases.¹⁸

¹⁸ Chaparro (2000) proposes a classification of mine producers according to their participation in each of the activities that compose the mining cycle. This cycle includes: (a) Promotion of the business, (b) exploration, (c) development, (d) production, (e) mine closure. According to the author, the “controlled” miners, are the formal producers that perform in each of the phases of the mining cycle. The “uncontrolled” miners are those informal producers that, having the capacity to execute the activities in each phase of the cycle, resist doing so and confront the State. More specifically, they are informal miners who have accumulated resources to increase their production capacity, prefer to stay at the margin of the law and not comply with the rules that govern mining

Faced with this more ample perspective of informality, the solution to this problem is not limited only to a campaign directed at title registrations, but also, to incorporate actions that tend to modernize and create professionals in the State organizations, intensify training in the technical areas (for a more efficient management of operations), in legal systems (to solve access problems and the use of mining resources), administrative (to develop the necessary capabilities amongst artisanal miners to convert them into corporate persons) and, principally the civic field (as sustainable development only functions with sustainable societies).

8.1 Definitions and Legal Codes

The concept of artisanal mining is not defined in the present mining legislation, nor has it been defined in previous mining legislations. Therefore, artisanal miners should comply with all the present regulations for mine producers such as: payment of patents and, minimum production requirements for the preservation of concessions, present environmental impact studies and/or adequate programs for the environment, technical requirements for the use of controlled consumables, etc.

Moreover, the present mining law (Legislative Decree 708) establishes the same requirements and regulations for anyone that desires to initiate a mining operation, independent of size. There is no distinction between the different mining strata (Large, Medium, and Small). Only for the effects of patent payments is there a distinction, where the small miner is catalogued by having a mine concession no greater than 1,000 hectares and a plant capacity of no more than 150 MT/day, and pays us\$1.- per hectare, as against those with more than 1,000 hectares who pay a tariff of us\$3.- per hectare.

Although in legal terms, artisanal mining does not exist, its existence in different geographic areas is undeniable. Gold production by miners with rudimentary technology and where labour is most intensive and, where capital is scarce, at a given moment the gold production of this section, was more than 50% of the total national production. The miners, generally work in other peoples' concessions (including those of the State), which differentiates artisanal mining from informal mining. As the artisanal mining activities are outside the law, these are exposed to very disadvantageous contractual conditions which prevent them from exploiting mineral deposits in a more efficient manner. Examples of these conditions are; they are paid prices far below international prices for their products and with excessive penalties, they are also charged higher than normal prices for controlled consumables. However, it is also necessary to recognize that not all informal miners can be considered as artisanal miners. Such is the case of some informal miners in Madre de Dios, who have totally mechanized operations with elevated production levels, and yet are exploiting deposits that do not belong to them. These miners cannot be considered artisanal miners, as their operations correspond to medium or even high technology.

activity. Finally, the "uncontrollable" miners, are the rightly named artisanal miners, who work on a small scale at subsistence level. Due to their precarious economic situation, they carry out primitive exploration and production and then abandon the location when the deposit is exhausted.

The sustainable development of artisanal mining and its effectiveness as an activity that contributes to the reduction of poverty, passes as a solution to the problem of informality. However, the present legal framework has requirements and demands that are too high for the artisanal miners to comply with. Norms are required that simplify access to mining property and the purchase of controlled consumables and, a definition of tax levels more in accord with the reality of artisanal mining.

8.2 Evolution of Public Policy

Public policy in mining has always rotated around the formal sector and with a basic preference towards providing incentives to encourage investment for large mining projects. The Mining Codes of 1950 and 1992 are explicit on this point. The reason is that mining has been looked upon as an activity to generate foreign currency, the larger the operation, the more it will contribute in this respect. Other considerations such as, the creation of jobs and the generation of technological education, have been absent from the legal framework. In this regard, it is understandable that voids are to be found in mining legislation with respect to activities with a relatively small impact on production and consequently mine exports.

Despite the fact that during the last three decades, artisanal gold mining has stood out as an important source of employment and is responsible for a significant part of the gold production in the country, mining legislation and public policy, have practically ignored this mining sector. Furthermore, until recently, there has not even been a clear identification of artisanal mining or how to differentiate it from informal mining.

In recent years, government authorities have recognized artisanal mining as an important source for employment and as an important mechanism for alleviating poverty. This situation has been emphasized by the interest shown by some technical cooperation programs. Thus in the mid 90's, the Ministry of Energy and Mining initiated a series of studies to identify the principle characteristics of artisanal mining in the four main zones where they are gathered (Madre de Dios; Ica, Ayacucho and Arequipa; Puno and La Libertad).

One of the most important results of these studies, is that the level of informality in this mining sector is extremely high and that the development of this activity must be based on solutions to the problems of legal access to the areas being worked. Such is the case, that in Puno, the State took the initiative of facilitating the granting of exploitation concessions to organized mining groups. This initiative was possible as the deposits belonged to a State owned company that was not working them. This solution is more difficult in other mining areas, as private companies or individuals are the concession holders.

However, the State is conscious that measures have to be dictated that are conducive to facilitating the legal access by the artisanal miners to the deposits they have been working informally. (Llerena, 1999) has established that present legislation, permits artisanal miners to formalize their situation by converting into: (a) concession holders, by acquiring mining rights; (b) assignees, through assignment contracts with the title holders; (c) contractors, through exploration and/or production contracts with title holders; and (d) partnerships through joint venture partnerships with the title holders.

All the options mentioned require partnership schemes in order that the artisanal miners comply with the legal requirements of present legislation and so that they may acquire an adequate level for negotiating, when the selected option is to sign a contract with the title holder of the concession. Educational schemes are required to improve the level of legal knowledge of the artisanal miners; technical education to raise the efficiency of their operations and, education on environmental management in their operations. These areas of education, are the pillars for the assistance programs for artisanal miners.

8.3 Impact of public policies on the behaviour of artisanal and small mining

As mentioned previously, present legislation has a single frame for mining activity and does not distinguish the different characteristics of mine operators. Moreover, with the objective of modernizing and making the mining sector more efficient, some technical and environmental requirements have increased, which cannot be met by small companies and much less by artisanal miners.

The lack of initiatives for the support of the small producers added to the ever more difficult conditions imposed by the metals markets, have cause many small companies to close their operations. So much so, that small companies dedicated to the production of basic metals, have practically disappeared and the only survivors are those dedicated to gold. However, the decrease in the gold quotation in the last few years, has resulted in a hard blow for the companies and has caused many to close down. It is in this context that there has been a sustained growth of principally artisanal mining, through the exploitation of deposits left by small mining companies. In other cases a relation occurs between small mining companies and artisanal mining, where the companies see in the artisanal miners an efficient way to subcontract mine work and dedicate themselves only to beneficiation in their plants. In both cases, the weak legal position of artisanal miners makes them subject to abuse.

Once again, the present legislation has to be modified to introduce the necessary mechanisms so that both small and artisanal mining have the adequate routes to follow and become sustainable activities and important generators of employment.

9 Support Initiatives and Proposals for Artisanal Mining

Interest in artisanal mining, has only recently obtained importance in Peru. Although the mining law does not yet recognize artisanal activities, there are efforts on the part of sectarian authorities, together with multilateral and bilateral cooperation organisms and, non-government organizations. As in other parts of the world, the initiatives and support programs for Peruvian artisanal mining, have evolved from projects directed to solve technical problems, to ample programs that contemplate subjects such as economic, social, legal and environment.

9.1 The project for analysis, planning and execution of policies (PAPI)

The Peruvian government, with the financial assistance of the Agency for International Development of the United States, in 1994 and 1995, contracted detailed studies on the four mining zones where there is artisanal mining. These studies permitted obtaining a state of the art of this sector to serve as a basis for future projects. These studies not only focused on the principle technical problems but also paid attention to the socio-economic characteristics of each one of the zones. These studies also produced suggestions for lines of action and intervention in each of the mining areas.

9.2 The Artisanal and Small mining project (MAPEM)

This project, carried out by the Ministry of Energy and Mines, started its activities in January 1996. Although the area of coverage was, Madre de Dios, Puno, Ica-Ayacuchon-Arequipa and La Libertad, its activities centered in Madre de Dios. The MAPEM period for execution of the program was four years and the sum allocated was S/ 3,720,000 with an annual average of S/. 740,000.

The principle objective of MAPEM was, to “contribute to the orderly and efficient development of artisanal mining in harmony with the environment and with adequate standards of mining safety and hygiene”. The specific objectives were: (a) move the gradual legal order of the formalization of informal mining activities, incorporating it to larger scale operating units ; (b) avoid or lessen social, environmental, safety and hygiene impacts produced by artisanal and informal mining; and (c) educate on regulatory aspects and basic technology, environmental, safety and mining hygiene “ (Medina, 2000)

The MAPEM project, contributed to the formalization of 80% of the mining operations in Madre de Dios , the principle instrument was the passing of the Decree Law No. 851, that granted preferential rights to the applicant miners, who were informal miners working in free areas. It also contributed to environmental sensitivity with respect to the adequate use of mercury, by demonstrations and the distribution of more than 1,500 mercury recovery vessels (retorts) and mercury reactivators. As part of the environmental recovery objective, a forest nursery was installed in Huaypethue and a pilot reforestation program of 8 hectares was planted. Additionally, the project has contributed to educating miners through the publication of information leaflets and by seminars and educational workshops for safety and mine hygiene, environmental aspect and mine technology.

Apart from the success obtained, the importance of the MAPEM project, lies with the fact that the intervention practiced, has served to lay the foundations for new projects and having opened the field for other institutions to work on the subject.

9.3 Project for the minimization of environmental impacts in Madre de Dios

As a consequence of one of the lines of work of the MAPEM project, the Ministry of Energy and Mines, designed the project Minimization of Environmental Impacts Originated by Gold Operations in the department of Madre de Dios . This project is supported by the Federal Institute of Geosciences and Natural Resources of Germany

(BGR) and the German Agency of Cooperation for Development (GTZ) and to the Ministry of Energy and Mines. The German non-reimbursable contribution is an initiative of us\$1,200,000, complemented by a national contribution of us\$ 100,000 in the form of technical personnel and equipped offices.

The objective of this project is to contribute to the sustainable development of the Madre de Dios area, and specifically the Huaypethue and Caychive areas and other priority areas close to Puerto Maldonado.

This project is being executed in its first phase and will have a duration of three years.

9.4 The GAMA project

The project Environmental Measures in Artisanal Mining (GAMA) is a program financed by the Swiss Agency for Development and Cooperation (COSUDE) and by the Ministry of Energy and Mines. The financing of this project has a Swiss non-reimbursable contribution of us\$1,330,000 and a national counterpart of us\$300,000 for a period of three years.

The objective of the GAMA project is to improve the environmental situation of artisanal mining in the Puno, Ica, Arequipa and Ayacucho areas. For this purpose, GAMA plans four action areas: technical environmental, environmental health, organizational economy and legal-administrative. The technical environmental area has the objective of mitigating environmental contamination produced by the beneficiation of ores, improve the working conditions of the miners and improve the sustainability of mining activities. The environmental health area intends to diminish the impact caused by artisanal mining work and of the affected population, improve health and environmental conditions and the inter-institutional coordination in this respect and to obtain adequate systems for environmental healing and primary health attention. The organizational economy is to contribute to an improvement of procedure capacities of the productive organizations and obtain that the more capable organizations drive the sustainable processes for the improvement of the environmental situation and of the quality of life of the artisanal mining communities. The legal-administrative area seeks to propose legal and administrative conditions for sustainable artisanal mining and to promote environmental norms, control mechanisms and fiscalization of artisanal mining (Mosquera et al., 1999)

The first phase of this project that was initiated in 2001, will have a duration of two years. During this phase, individual projects will be financed to cover the above-mentioned actions.

9.5 Initiatives of the multilateral organizations

Program for the elimination of children's work (IPEC)¹⁹

The International Labour Organization (OIT) with their program for the elimination of child labour, has been financing projects in a first phase, of a series of non-government organizations, in different mining settlements in the Mid South. These institutions have carried out important work, sensitizing adults with regards to the problem of child labour. Understanding the causes that generate child labour in these communities, has permitted an increased acceptance of the initiatives destined to fortify the social organization and the educational system, and those destined to the improvement of infrastructure of the communities and to expand the productive options to increase the income of the parents.

The main lessons learnt in this first phase have been, in the first place, integral strategies are required for the elimination of child labour. The children work principally because the parents income is insufficient to maintain the family. For this reason it is necessary to improve the technology used by the miners and, generate productive activities for the women amongst others. Secondly, it is necessary to implement a policy against poverty on the part of the municipal authorities. This provides an institutional infrastructure for the efforts made by the intervening organizations and the population itself. In the third place, it is necessary to involve all the State entities. Thus, monitoring and regular control by the Ministry of Labour is required, as also intervention on behalf of the Ministries of Health and Education, to resolve problems in these sectors and that have an impact on the decision on whether children work or not. Fourth, information is required on the groups of institutions, in order to increase the efficiency of the participation of the different institutions. Finally, it is indispensable that the community participates. The inhabitants themselves should become agents in their own communities and avoid in this manner the problem of assistance and the capacities of the population increase.

In August 2000, the IPEC program initiated a second work phase, in which more importance will be given to work on a sectoral level. They will try to focus on the child labour problem in a macro form and not centered on particular problems of each mining population. In this sense, there are efforts being made to consolidate an Intersector Round Table on Child Labour in Artisanal Mining. At the same time, in this second phase, activities have commenced in Bolivia and Ecuador and in Puno, Peru. At this time, the intervention work in Peru is much more advanced due to the previous experience obtained in the first phase, however, both in Bolivia and Ecuador, important advances have been made in the legislative part. In Peru, they are just working on this subject with the support of other institutions such as the GAMA project.

Cooperation group for Artisanal and Small Mining (CASM)

The World Bank has just formed the Cooperation Group for Artisanal and Small Mining, with the objective of reducing poverty through the support of sustainable development of

¹⁹ This section has been prepared thanks to the information provided by Mrs. Rocio Valencia, IPEC Coordinator.

the affected communities or those involved in artisanal or small mining. This initiative comprises of three main activities: the coordination and establishment of networks between different actors, the interchange of information regarding experiences and the identification of sources of financing for projects and proposals.

9.6 Lessons learnt by the localized support initiatives to artisanal mining

The support initiatives to artisanal mining in Peruvian mining communities, began in the mid 90's. The majority of these initiatives have been carried out in communities in the Mid South as the Catholic Church started a series of assistance activities after the 1996 earthquake that devastated this zone. This work by the church, opened the road to other institutions that became interested in these communities. The International Labour Organization in particular, through its program for the elimination of child labour, gave important support to the institutions that worked in these communities. For this reason, it is in the Mid South communities that a major advance can be observed in regards to, community organization, infrastructure and elimination of child labour and provision of social services amongst others.

As will be appreciated below, the main lessons learnt in this decade of intervention are, first, that the strategies that support these intervention projects must be integral. The artisanal mining problem covers technical, social and economic aspects, for which multi disciplinary focuses must be employed for their solution.

Second, the preparation of intervention projects should take into account the surroundings and all of the agents that intervene in the chains of local values, as these could turn into serious obstacles in order to reach the objectives of the projects and, even put a break on the progress made in the organization of these communities.

Third, community participation should be the corner stone in any intervention project. Although participation makes decision-making a slower process and can derive in mistaken decisions with serious consequences, it is also true that in this manner one achieves a major level of responsibility and an apprenticeship that increases the capacity of the inhabitants.

Fourth, there is an agreement on the part of the organizations that work in these communities, that it is necessary to pass from local efforts to global efforts. This is necessary because part of the solution to problems of artisanal mining, require the preparation of policies at central government level, such as, the modification of the Mining Law or the definition of strategies for health and education for artisanal mining areas. This feeling is to a certain point, that of the artisanal miners who, over a period, hope to form a national federation of artisanal miners.

Fifth, global efforts have conduced to an interest in creating institution networks. For example, efforts are being made to create an Intersectoral Work Table, that counts on the support of the Ministry for the promotion of the Woman and Human Development, to treat the subject of child labour in artisanal mining. Also, about eight institutions have met to form an Artisanal Mining Network.

Finally, it is necessary to make compatible the capacities of the mining communities and the intervention organizations with the requirements of the projects. More ambitious projects such as the one for a treatment plant, require the development of more sophisticated capacities. In this sense, a very fine balance is required for the definition of the objectives of a project. If more limited objectives are chosen that fit in with the capacity of the community, there is always the danger of maintaining a situation that is a disadvantage for the miners and does not go towards a sustained development of the communities. This leads us to ask ourselves, what should be the role of the intervening organization. On the other hand, if one chooses to take a leap that totally alters the commercial and organizational relations between miners and other agents, there is the risk that the intervening organizations are not prepared to help the communities that take the leap.

*Santa Filomena (Ayacucho)*²⁰

The first support initiative in this mining township was in 1996 after the earthquake that devastated the area. In this opportunity, the non-government organization IPEMIN assistance was channelled through the existing mother's clubs. Later, COOPERATION with financing from CARITAS started a project to assist women and children, specifically in the health and educational areas. A census was carried out to identify the population. In a second phase, strategic planning work was done in five themes, following the outlines of the IPEC and OIT programs: (a) technology improvement; (b) reinforcement of health and education services; (c) income generation; (d) institutional development and (e) sensitisation of the population.

The main instrument used by COOPERATION in its work, is Participation Planning. At all times, attempts were made to maintain a constant interaction with the community and that it should be the one that defines its necessities. Despite the fact that this focus could have been the reason for predictable errors to be committed by the community, COOPERATION decided not to interfere in these decisions. Signed agreements were made with the population in order to assure commitments. Also, work was carried through different agents in the community, according to their competence. For projects on the subject of race, work was done directly through the mother's clubs; in health and education, through the municipal agent who has closer contact with the authorities in these areas; in productive and technological subjects, with SOTRAMI (The Society of Mine Workers S.A.) and in security, with the Lieutenant Governor.

One of the principle achievements obtained in this township, is a greater power of decision and participation for the women. In the beginning, women's participation was very weak due to the lack of experience, but it was obtained that they gained confidence and felt that they had more right to participate. At first, this generated resistance amongst the miners. Likewise, in the project for the elimination of child labour, it was possible to create an awareness in all the population. Although at the beginning work was done with the mothers, at this moment, the subject is the competence of the entire population. On the other hand, a grave fault in this project, is that a mining winch was installed to permit the

²⁰ This section was prepared based on the information provided by Miss Kathia Romero of COOPERATION.

mechanization of a mining operation in an area that belonged to another titleholder, which produced a legal problem. This error occurred due to lack of knowledge on the filings and to have installed the winch before completely cleaning the legal situation in the zones where the miners operate.

Huanca²¹ (Ayacucho)

Intervention in Huanca also started as a result of the earthquake in 1996. The Health and Work Institute (ISAT) initiated an assistance project, which required the participation of the inhabitants, which was done through the mother's committees. It is important to mention that some of the Huanca inhabitants, had already organized and formed mining companies, however, these companies were not able to assume the tax load imposed by the Mining Law.

After the previous intervention, ISAT worked with a base focused on sustainable human development, based on four initial points: work, health, the environment and the actor himself. Through a process of participation by the population, it is decided that the mercury problem is one of the principle priorities. To this end, they dedicated themselves to the promotion and use of retorts.

In the subject of miner's organizations, a new miners company has been formed , that established an agreement with the company DINACOR which is a leaser of the titleholder of the mine concession. This scheme has been adopted, whereby the miners legalize their activities, but the form in which they articulate in the zonal chain of values is maintained. However, this scheme which was decided by the miners, tends to raise their costs as the royalties rise due to the presence of the intermediate company. On the other hand, this scheme maintains a "status quo" in the relations which is generally adverse to the miners.

Regarding the subject of the women's organization, it has gone through a process whereby the focus on assistance has converted into a focus on production. In this manner that a bakery was established and administered entirely by the women of the community and allows them to have an income equivalent to a day's work in mining activities.

One of the main achievements of the ISAT intervention, is the "empowerment" of the inhabitants. Despite possible errors they may commit, the inhabitants are capable of rehearsing strategic planning exercises where they evaluate their limitations and potentials. At the same time, they are appreciating the apprentice process, based on their own experience and that of other mining townships.

²¹ The information necessary for the preparation of this section, was provided by Miss Anita Lujan of ISAT.

*Mollehuaca (Arequipa)*²²

Intervention in Mollehuaca dates from 1993. The leaders of this mining community go to the Prelature of Caraveli to ask advice and support, due to an unjust accusation. The Prelature takes interest in the case and, through the Episcopal Commission for Social Action, initiates activities in the township. A company of miners is formed named Comunidad Minera Mollehuaca S.A. with about 300 members. In like manner and through workshops, they identify that one of the principle problems of the township, is their dependence for ore beneficiation. They present to the General Counterpart Fund Peru-Canada and the General Counterpart Fund Peru-Japan, a project to increase income and quality of life of the inhabitants of Huanu (district where Mollehuaca is located). One of the central objectives of the project, is to install a plant to beneficiate 20 MT /day of ore to benefit the partners and 2,500 artisanal miners in the area. The plant commences to function in February 1997. Also, in this project, the miners company obtains title to several claims for a total of 2,100 hectares.

The project finds an adverse reaction on the part of the company that monopolized ore beneficiation in the zone. The beneficiation company becomes hostile towards the directors and staff of the miners beneficiation plant, paying higher prices to the artisanal miners so that they do not sell their production to the Molehuaca plant. This turned out to be fatal as the plant has to function below it's installed capacity and consequently cannot cover its costs and the plant has to shut down. At the same time, the miners lose confidence in each other and the social cohesion starts to break down.

The Mollehuaca experience gives two important lessons. On the one hand, the importance of the surrounding situations and the agents that wander around mining populations. The Mollehuaca community has a long history of conflict with the company monopolizing ore beneficiation. The presence of a new treatment plant and the granting of mine concessions, put the monopolistic company on one side and it was only to be expected that their reaction would be to use all the means at their disposal, even illegal, to revert the situation. On the other hand, such a grave conflictive situation, requires a series of capabilities on the part of the directors and staff of the company, that were superior to what they had.

10 Conclusions and recommendations

Artisanal mining is an economic activity that is carried out principally in four geographic zones in Peru: Madre de Dios, Mid South (Ica, Ayacucho and Arequipa), Puno and La Libertad. It is estimated that between 20,000 and 30,000 persons are dedicated to this activity in the for zones. The difference in the figures have to do with, whether or not seasonal and/ or part time workers are included and, with the extremely conservative figures given by official organisms.

²² This section was prepared based on the information contained in (Villaran and Cortina, 1998), reports prepared by the Mollehuaca Mining Communit S.A. and on information given by Mrs. Zoila Martinez

Although the four artisanal mining zones have common problems, such as, poverty of the miners settlements, deterioration of the environment, health conditions and child labour; it is also true that each have their particular characteristics. In the first place, Madre de Dios, a department that neighbours with Brazil and Bolivia and where are located areas of great bio diversity, has the largest production of alluvial gold and the greatest number of informal miners in the country. The mining operations cannot be considered as artisanal due to the high level of mechanization and, as a result, the investment is high., in comparison with formal small and medium sized mining. Before the intervention of the Ministry of Energy and Mines through the MAPEM project, Madre de Dios was the centre of informal or “uncontrolled” mining.

Second, the Mid South includes the departments of Ica, part of Ayacucho and Arequipa. It contains more than 60 mining communities that work primary gold deposits . In this zone, that was once agricultural , artisanal mining has attracted a great quantity of people displaced from the zones violence and represent the principle economic activity. The major part of the operations utilize rudimentary technology with very little mechanization. In the Mid South, the type of ore defines the productive process as well as the relations between miners and other productive agents. It is thus that “quimbalete” operators or owners of the rudimentary beneficiation equipment, become important links between artisanal miners and the beneficiation plants in the zone.

Third, in the elevated department of Puno, artisanal mining is carried out at high altitudes above sea level, in the same manner as on the lower eastern flanks of the mountain chain. This causes that both primary and alluvial deposits are worked. This department has the second largest concentration of artisanal miners after Madre de Dios . The mining operations are carried out in workings abandoned by Minero Peru, in glacial zones and forest areas close to the rivers (moraines). As a result, very rudimentary operations exist together with those that are slightly mechanized, but without reaching the level of Madre de Dios.

Finally in La Libertad, department located in the northern ranges of the country, artisanal mining is practiced mainly in abandoned workings of the mining companies. Of the four artisanal mining zones, this is the least, both in production as in the number of miners. However, it is the area with the most information.

Despite the differences between the mining zones, all share a series of problems. The first is the strong environmental impact that this activity has generated. Mercury contamination is the principle problem suffered by the four zones. The indiscriminate use and deficient handling of this substance , is responsible for the loss of about 105 tons of mercury in liquid and gaseous form. Erosion is one of the principle problems in the semi tropical zones such as Madre de Dios and Puno. The large earth movements necessary to work the gold bearing material, impede the regeneration of vegetation, impacting the ecosystem in this manner . The contamination of watercourses , especially in Madre de Dios and Puno, is due to bad use of chemical substances such mercury, fuels and lubricants amongst others. In like manner, exploitation of alluvial deposits signifies pouring large quantities of solid fines into the watercourses that increase the turbidity of the water, which reduces the quantity of oxygen and damages the flora and fauna of the rivers.

Another great problem that is present in all the mining areas, is the little safety and deterioration of the miner's health. Due to the precarious nature of this activity, the miners do not use protective equipment or implements, nor do they follow safety practices that are obligatory in formal mining, so that they are exposed to a series of accidents that can be fatal. If we add to this, that there almost no equipped health centres in the mining communities, that can attend these types of accidents, the degree of danger of an accident increases due to the lack of attention. This lack of protection, exposes the miners to a series of substances and situations that endanger his health. The exposure to dust in the tunnels causes bronchial affections and the noise and vibrations generate damage to the nervous system. Excessive effort causes damage to the spinal chord. The constant exposure to mercury gasses during the amalgam "burning" causes chronic poisoning and produces convulsions, speech difficulties, lack of concentration, ulcers, colic, vomiting and others.

Child labour is another of the great problems in artisanal mining. The low income of the miners, has it that children have to work in order to complement the family income, placing their health in danger, limiting their education and future development. Children participate in almost all of the mining processes and are consequently exposed to almost all the risks confronting the adults. Additionally, their dedication to work reduces the time available for education, more so if the communities do not count with a good educational infrastructure.

In view of the abandonment in which they work, one of the great worries of the artisanal miner, is to improve his organization. The forms of work organization are an obstacle to the miners. Schemes like the "cachorro", "enganche" and dependence on the quimbalote owners, have a high component of human exploitation. On the other hand, the illegality of artisanal mining operations and the conflict that these generate, is obliging the miners to organize themselves in different forms, in order to be able to reach agreements with other agents and to become title owners of the deposits they work. The formation of cooperatives and anonymous corporations are the organizational forms most adopted by the miners.

The subject of legality is not only a preoccupation of the miners, but is a priority that should be attended by public policies. The present Mining Law has a homogenic treatment for all the mining strata and does not even recognize the existence of artisanal miners. This impedes the formalization of artisanal mining operations, because without a scheme for this strata, the formalization costs are too high. The State has taken the initiative to formalize operations in Madre de Dios, as it's high degree of mechanization, many costs and requirements may be assumed for it's function. In like manner, the State together with other institutions, is trying to prepare a modification to the Mining Law, so that small and artisanal mining may have the necessary mechanisms for that mining activity to become sustainable.

Interest in artisanal mining has been increasing over the last ten years. Diverse public, private and international institutions are pushing initiatives and proposals for supporting this sector.. The initiatives have passed through the first diagnosis step of gathering information and localized intervention. At this time, the necessity to work on an integrated viewpoint has been accepted and to take artisanal mining as a whole to facilitate the design of public policies. This does not mean however, that localized intervention should be set-aside in the different mining settlements. This will continue being an important part of the

initiatives taken in favour of this sector and will have to incorporate a series of methods and focuses that have shown positive results in the last years. Such as the active participation of the mining communities, global strategies to attack any problem, an adequate balance between the objectives of intervention and the capacities of mining communities and intervention institutions among others.

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